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ELECTRICAL REVIEW

MARCH 1958 PRICE 1s 6d

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500 ,, ,, ,,	50 ,, ,, ,,
1 A ,, ,,	100 ,, ,, ,,
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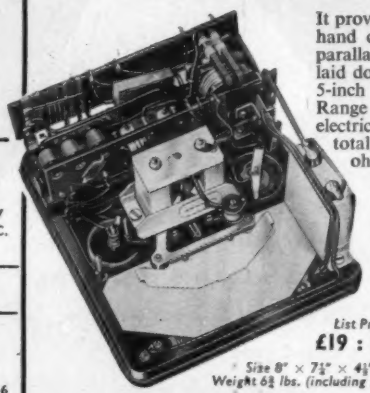

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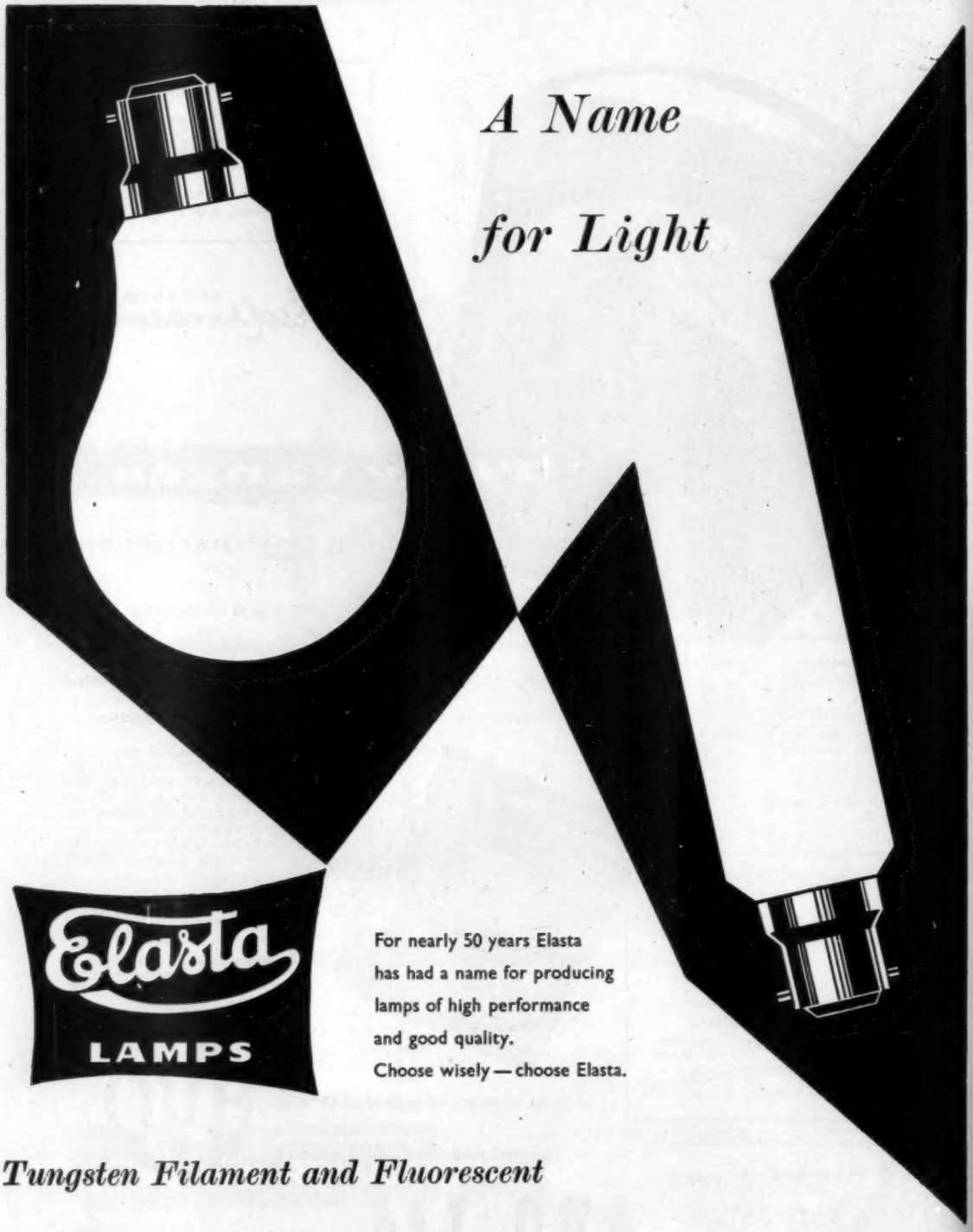

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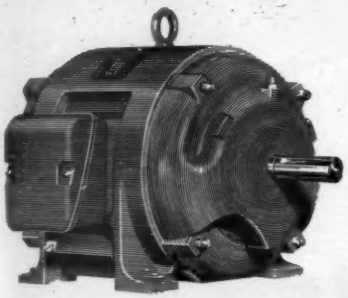

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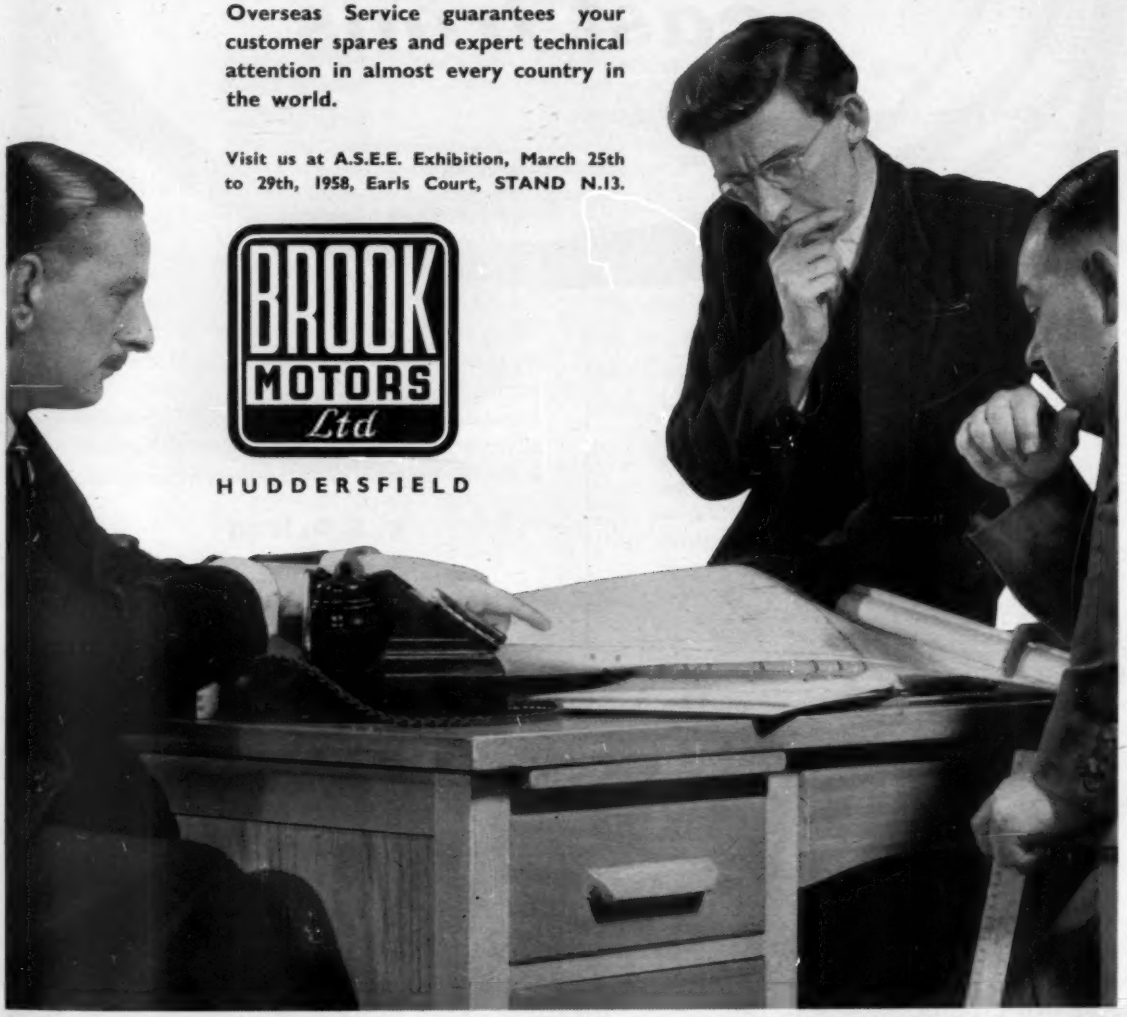

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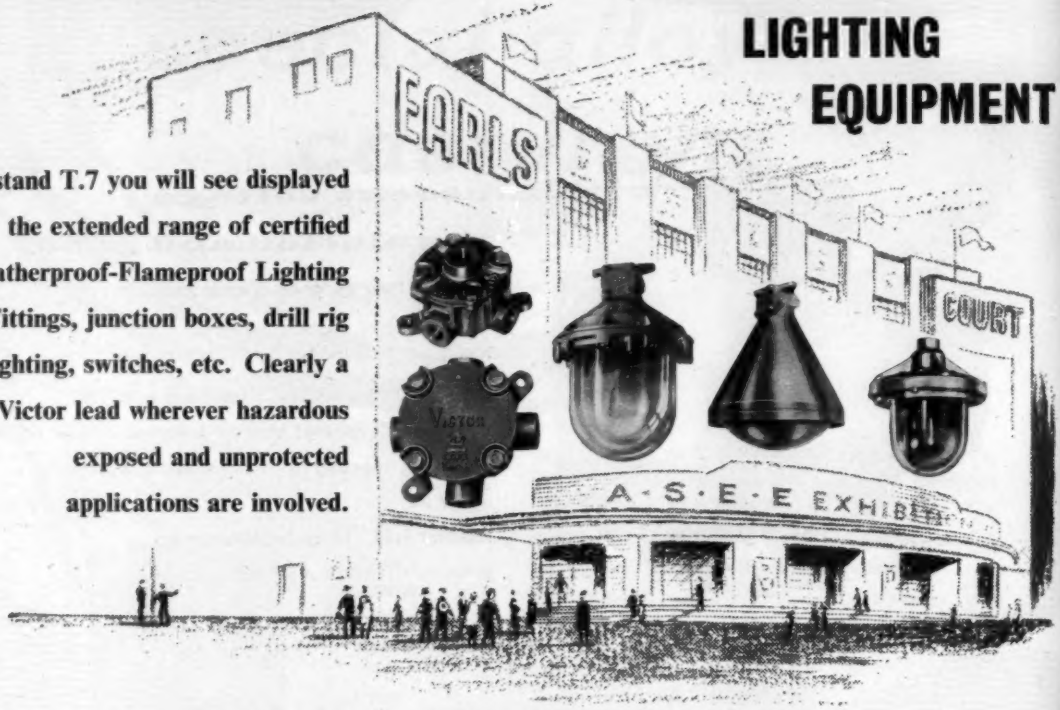

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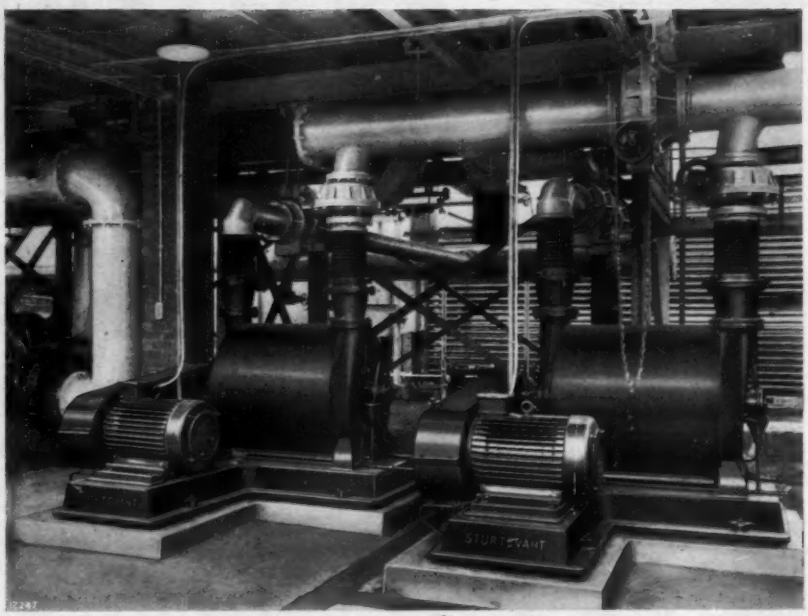

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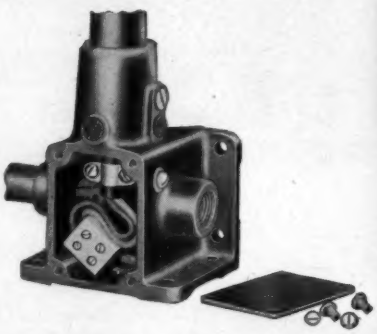

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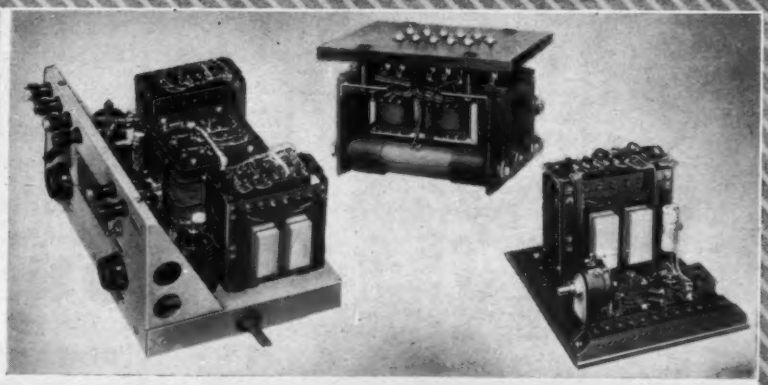

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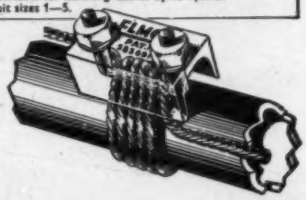

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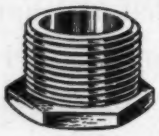

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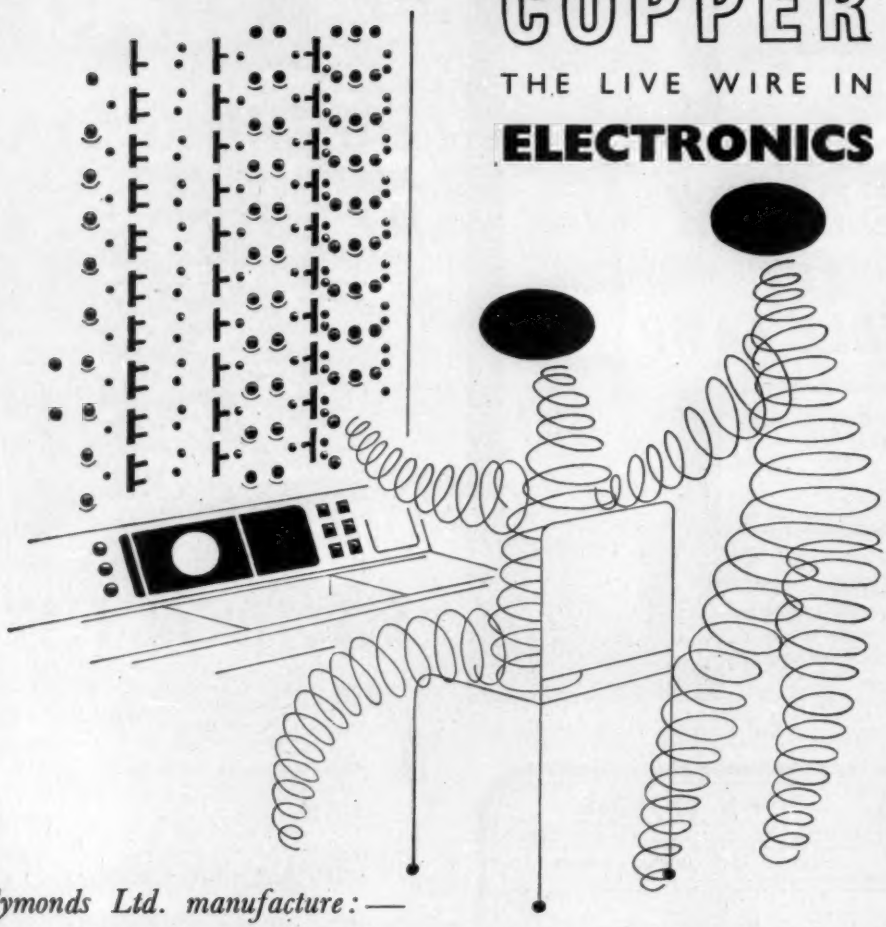

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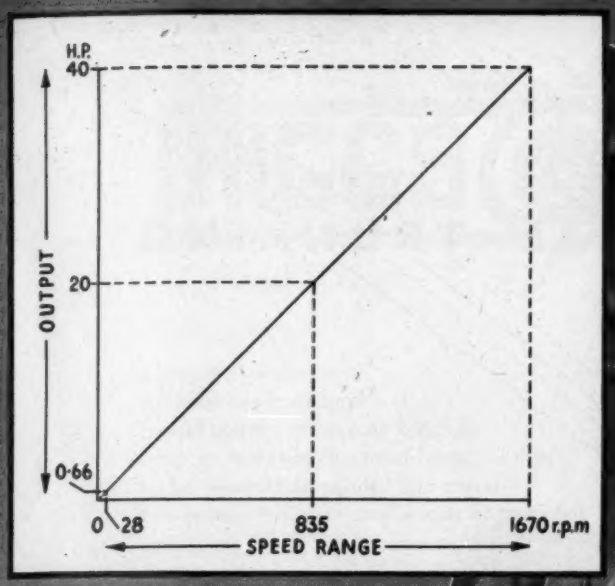

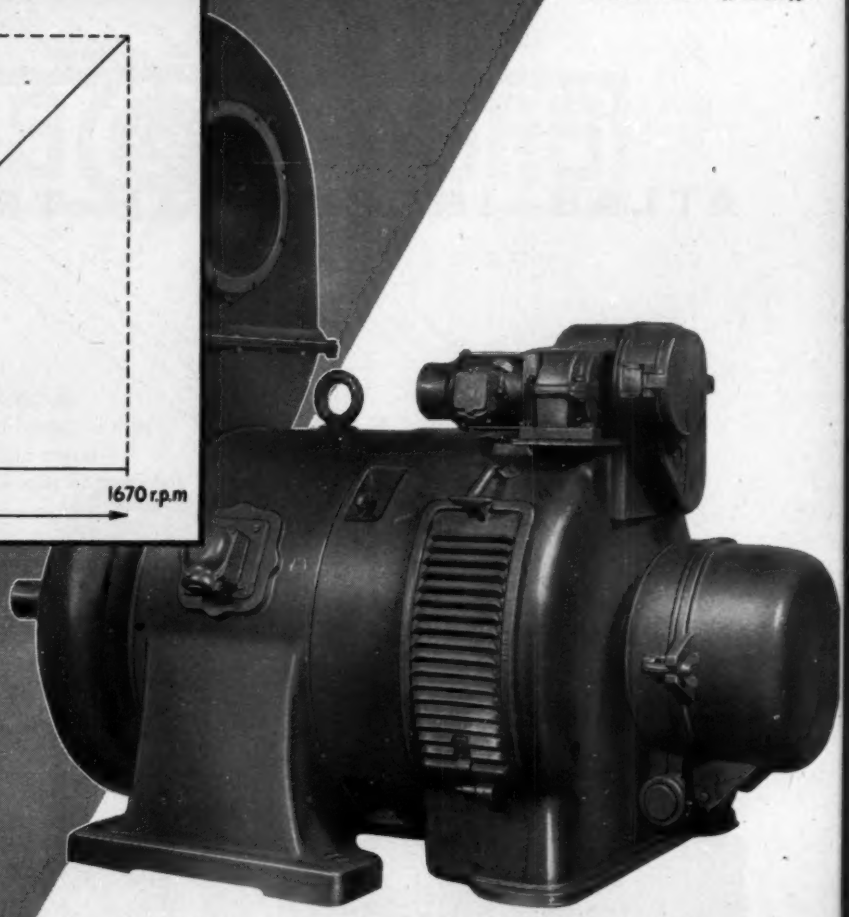

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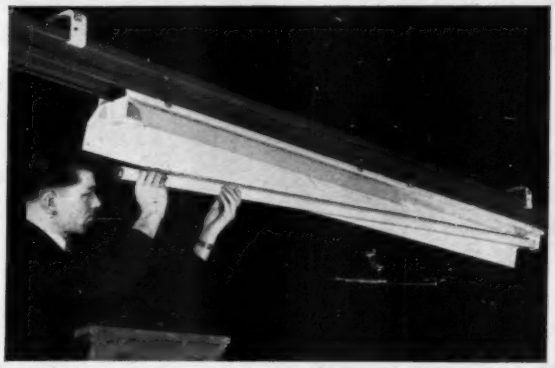

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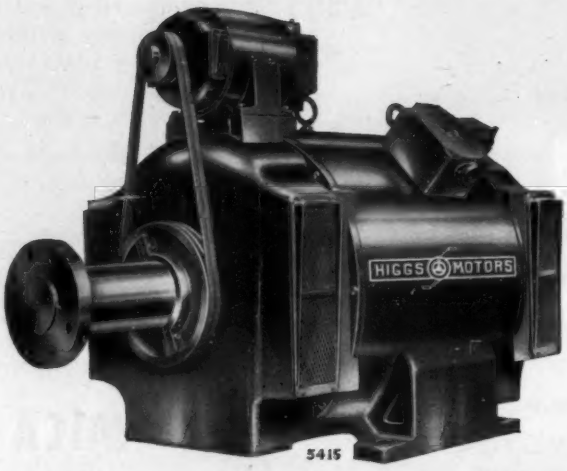

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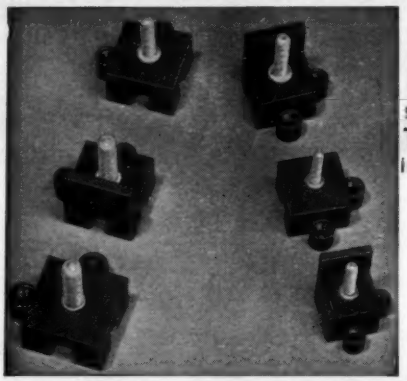

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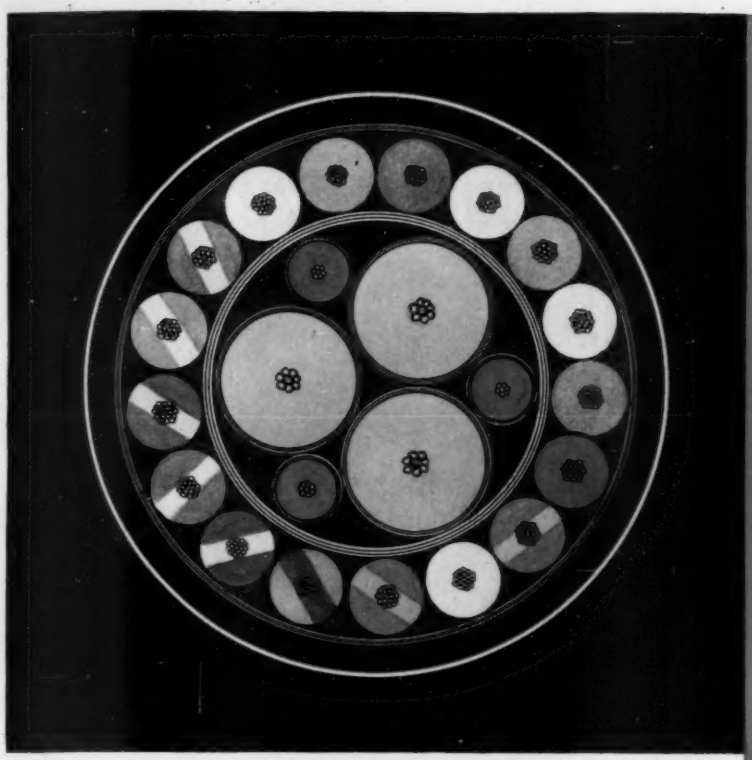

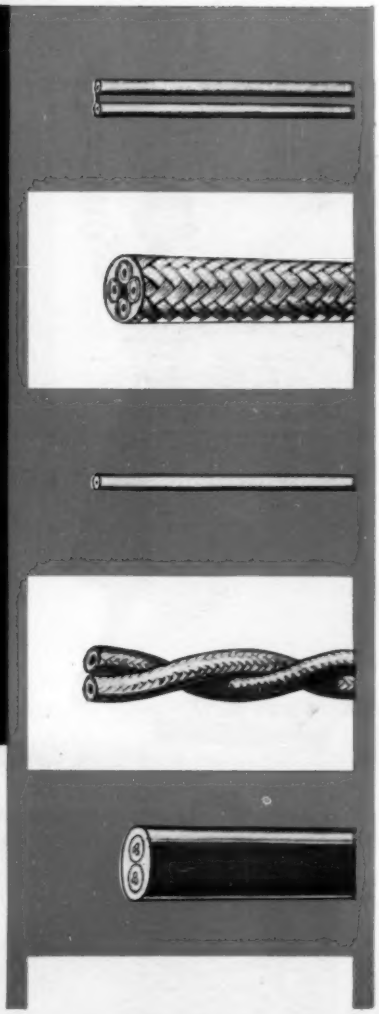

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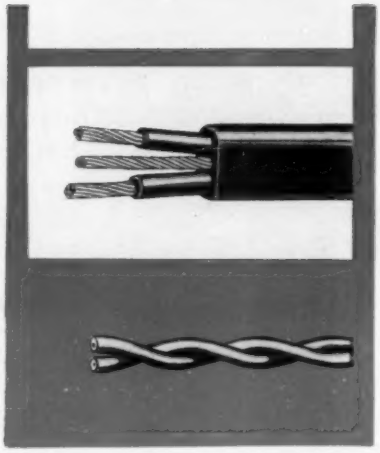

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LET THIS NEW SELLING IDEA MAKE MORE PROFIT FOR YOU AND A BETTER LIFE FOR YOUR CUSTOMERS

A woman with the *complete* Parnall Home Laundry saves pounds in laundry bills as well as *all* the hard work of washing, drying and ironing.
Each machine is an investment that pays endless dividends.

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The **PARNALL** *EW 50 washer wipes out laundry bills — averaging £1.14.2d. weekly for a family of four — and very quickly pays for its cost.*
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(Have you received our January 1958 Catalogue ?)
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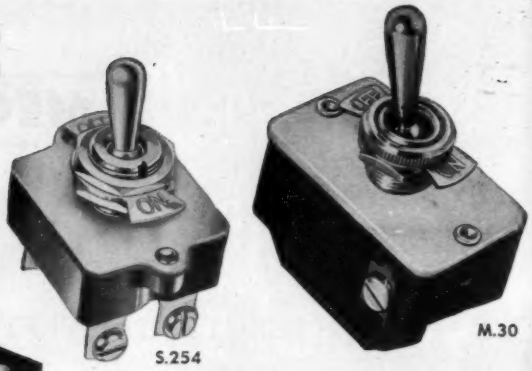

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T.280	Sensitive snap action switch
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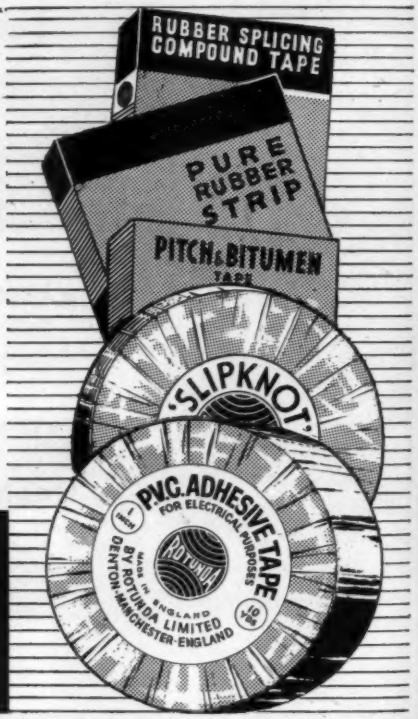

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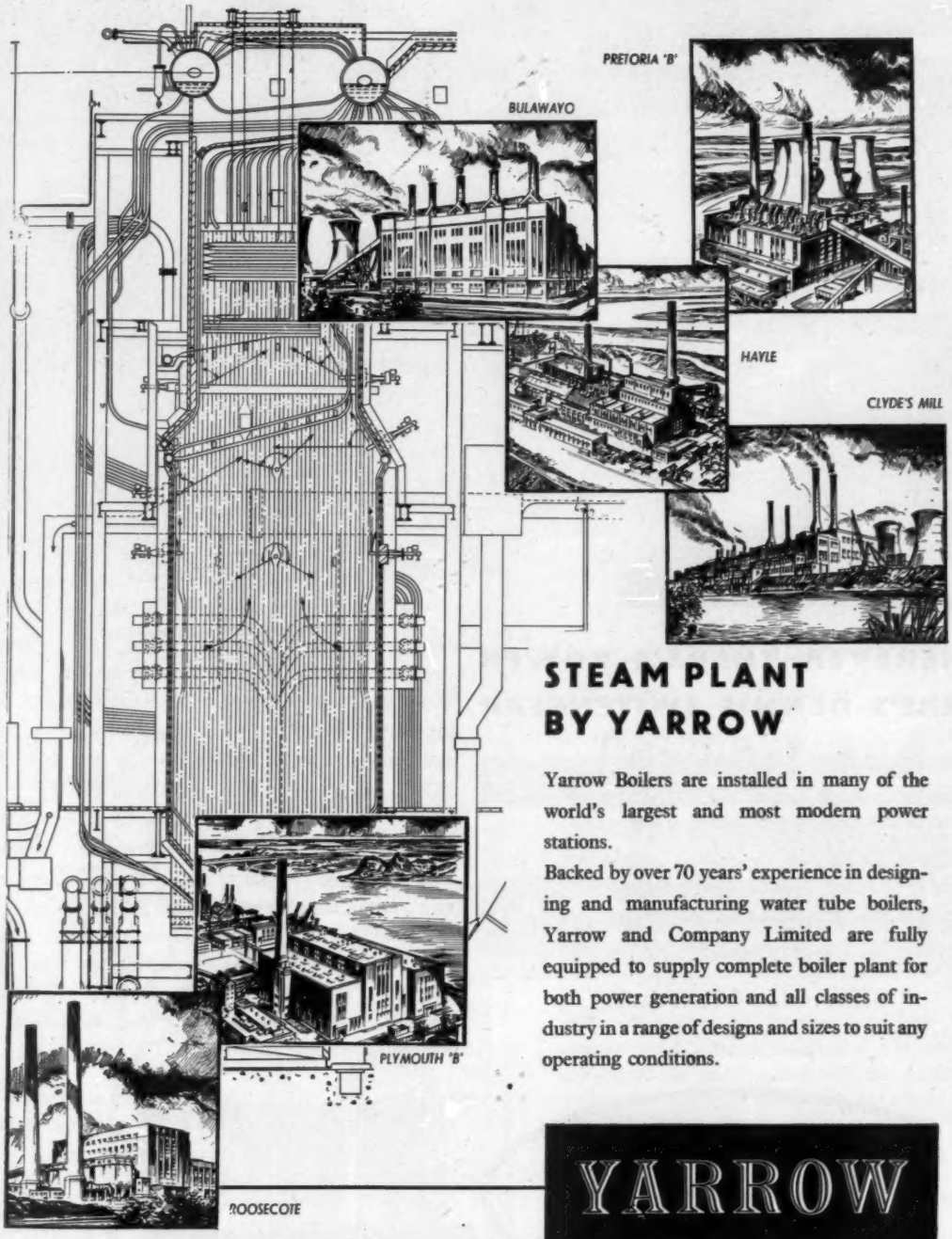

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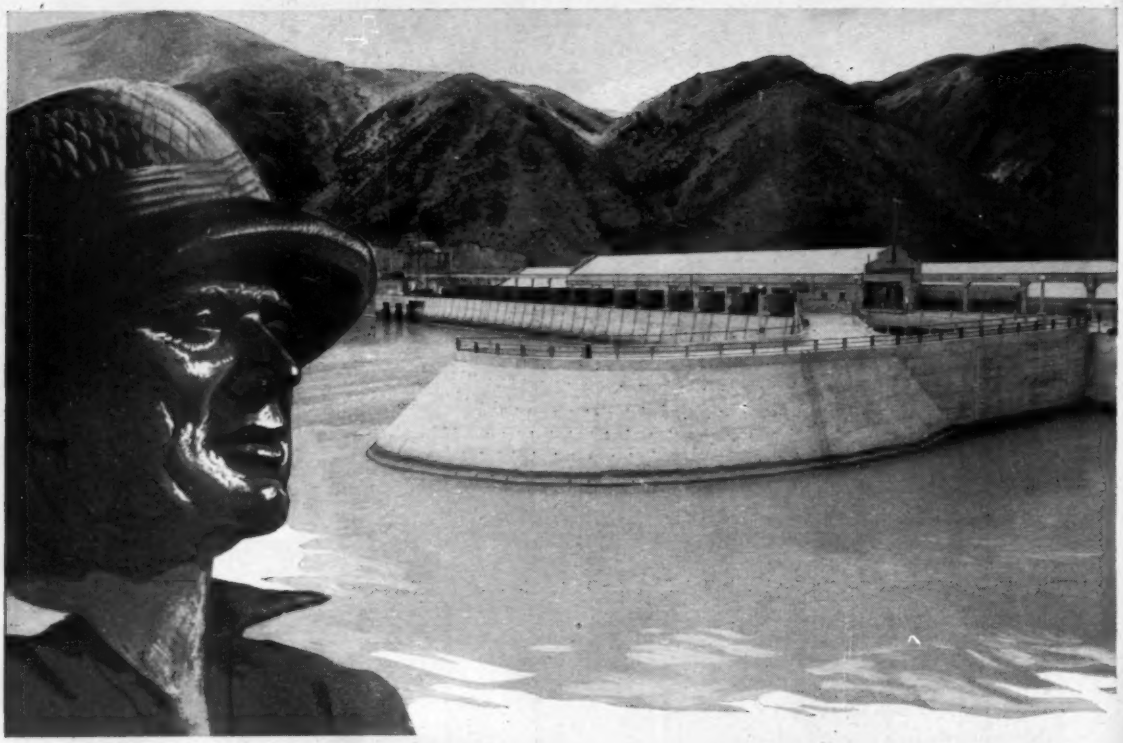
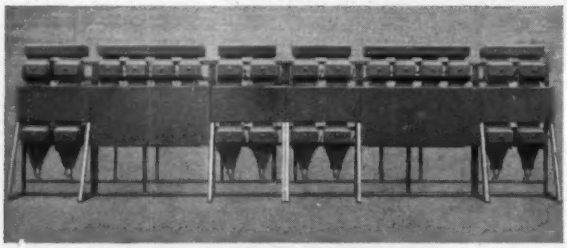


WHEREVER THERE'S POWER THERE'S DENNIS SWITCHGEAR



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An example of medium voltage distribution switchboard for Atomic Power Station.

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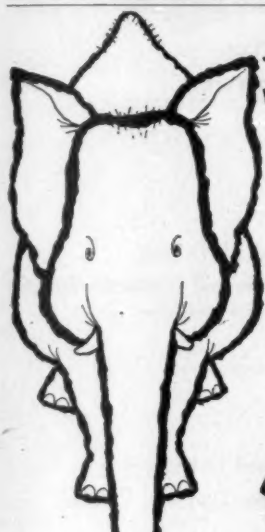

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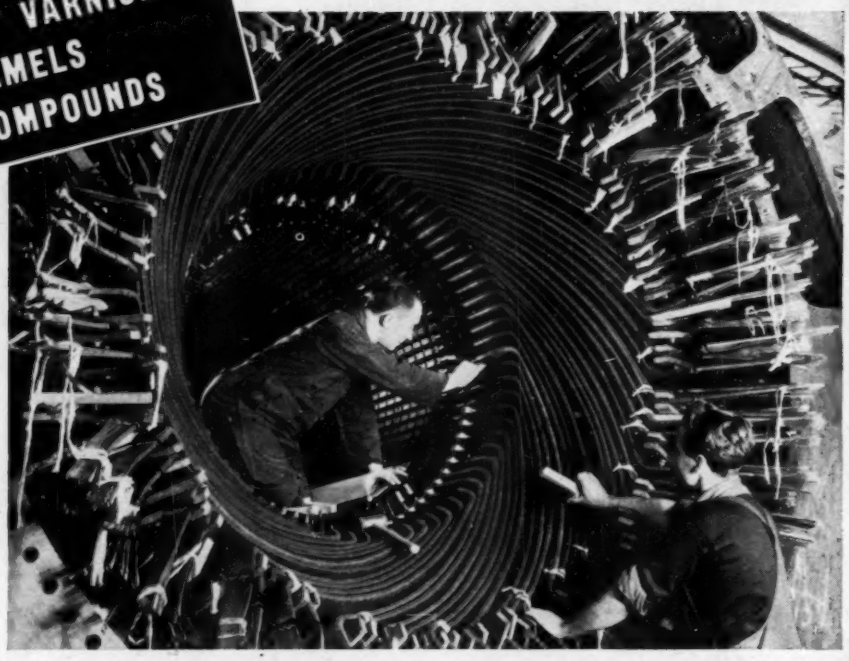

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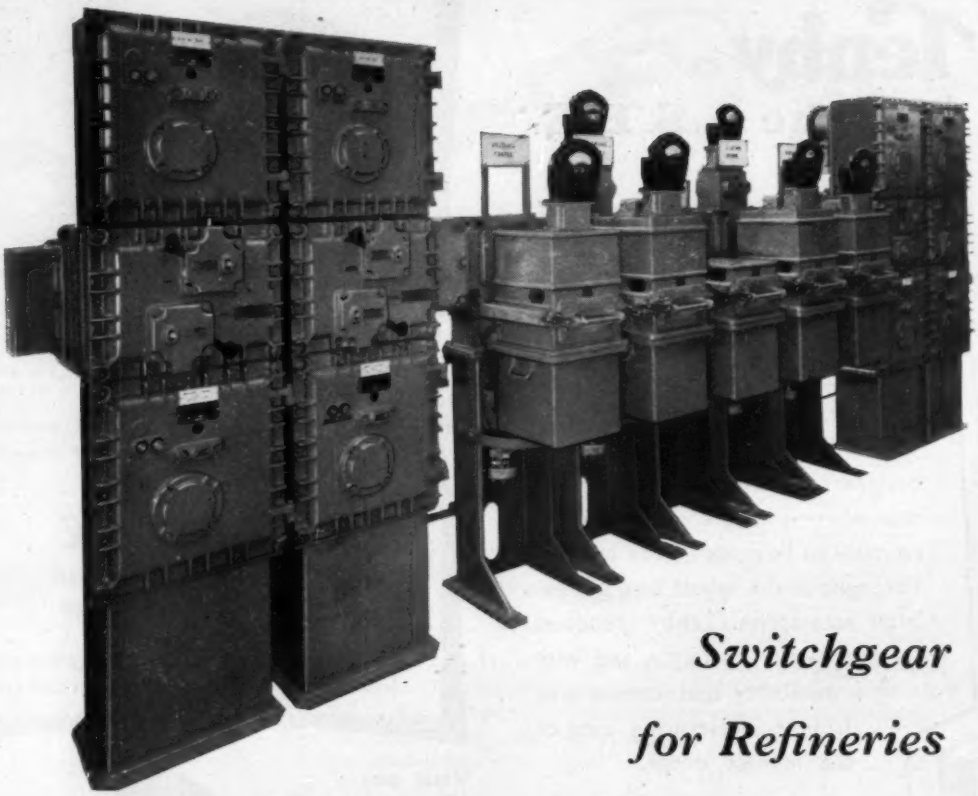

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protect life—
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Electro Motive Force measured for industry

What do you look for in thermocouple wires? Consistent EMF values? Stability? Long life? Combinations for different temperature ranges?

British Driver-Harris thermocouple wires are manufactured to specifications which ensure that they are indisputably satisfactory on all four counts.

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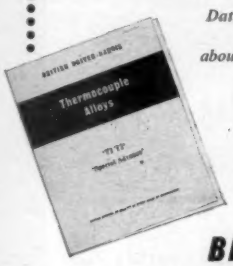

Data Sheet No. 2 gives basic information about our thermocouple alloys. Have you had a copy?

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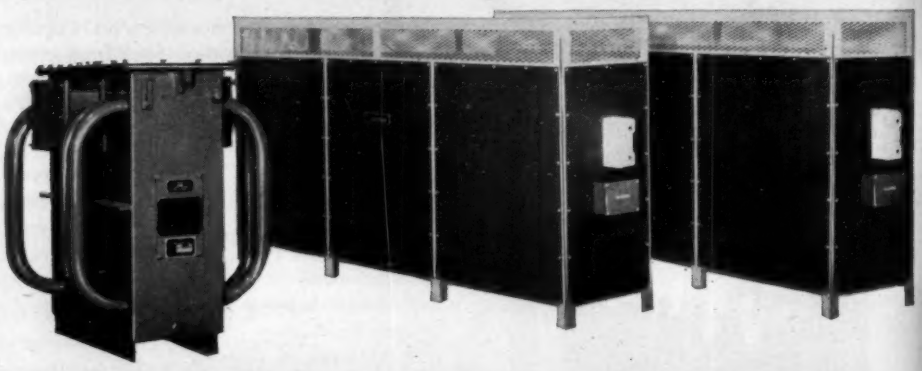

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G.E.C. manufactures rectifier equipment to suit the needs of every industry.

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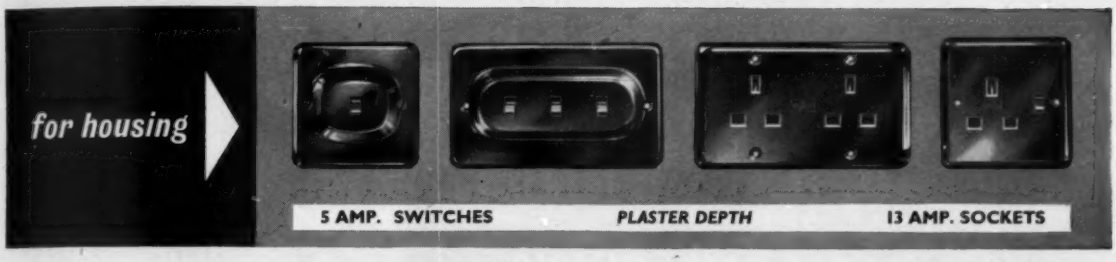

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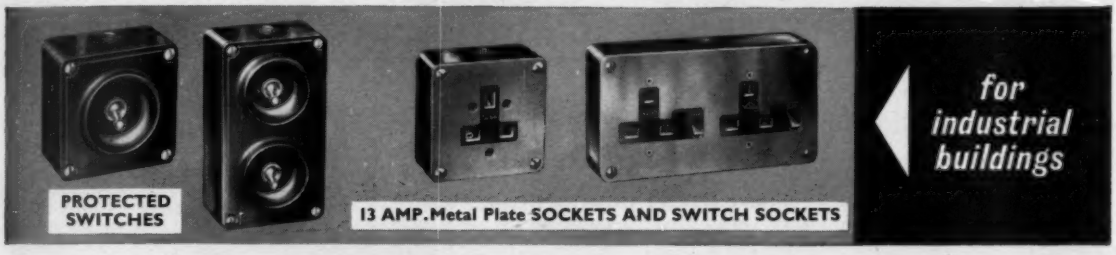

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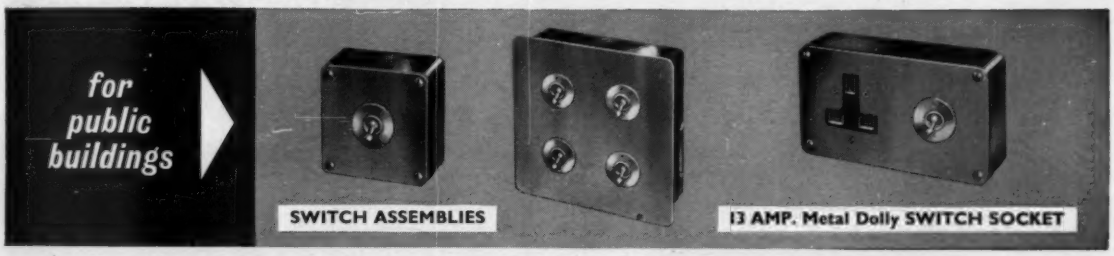

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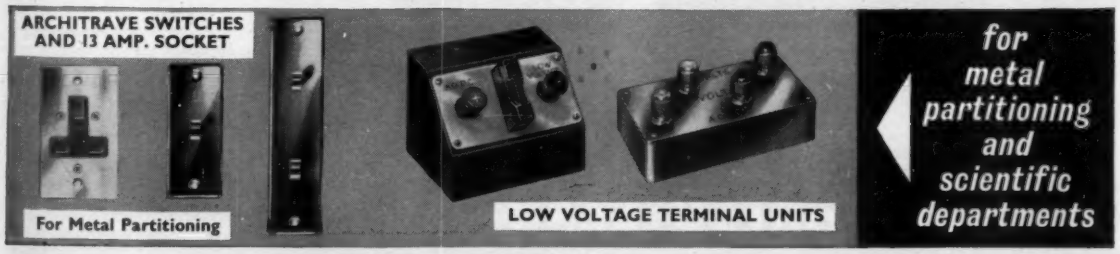
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For Metal Partitioning
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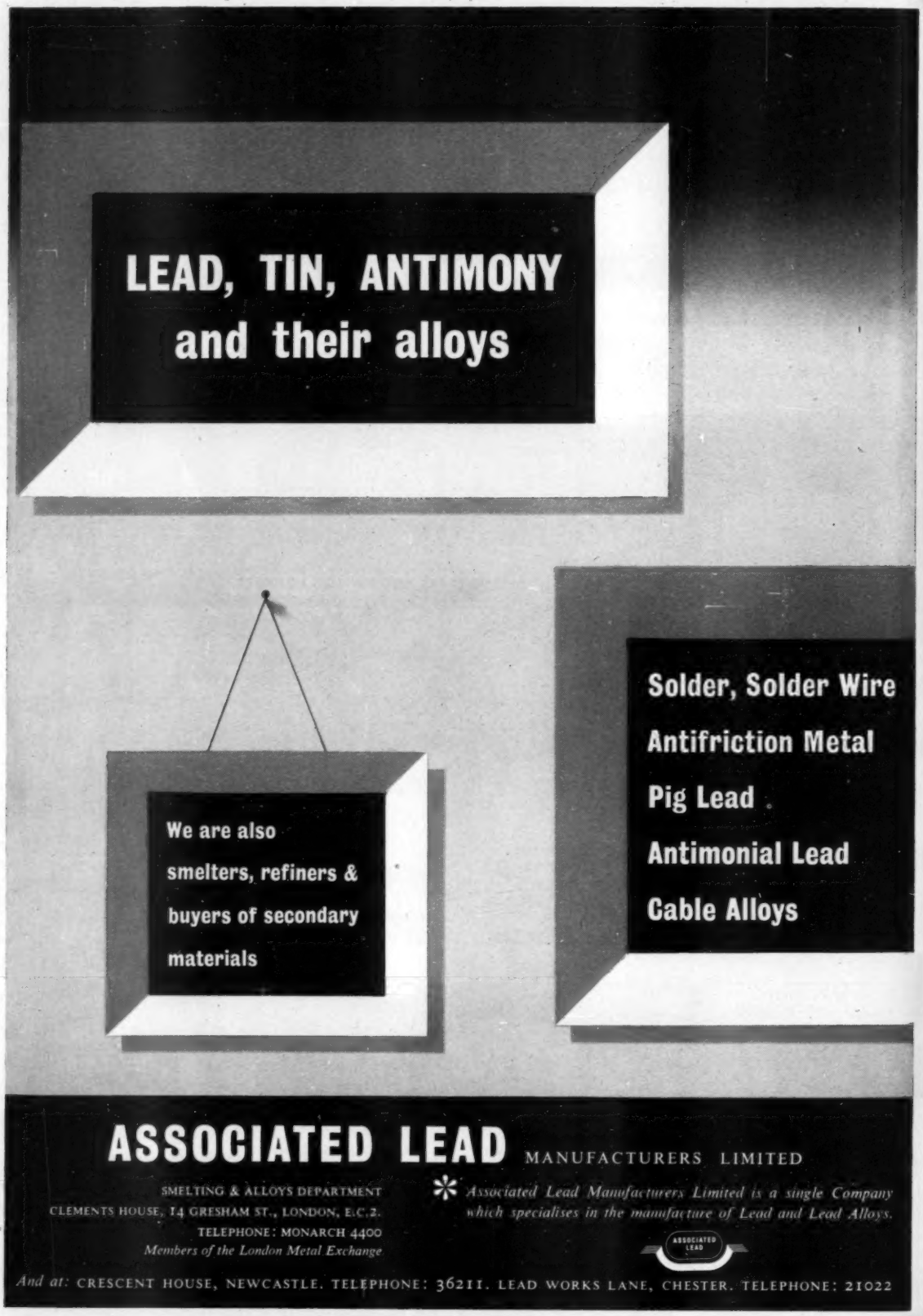

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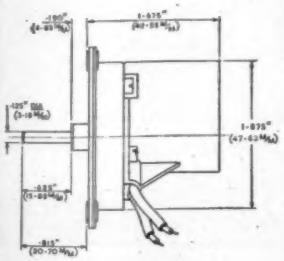

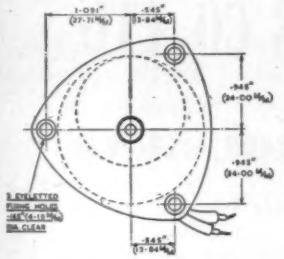

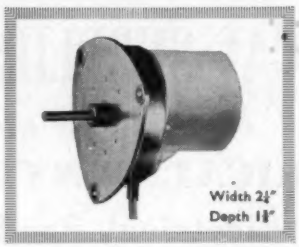

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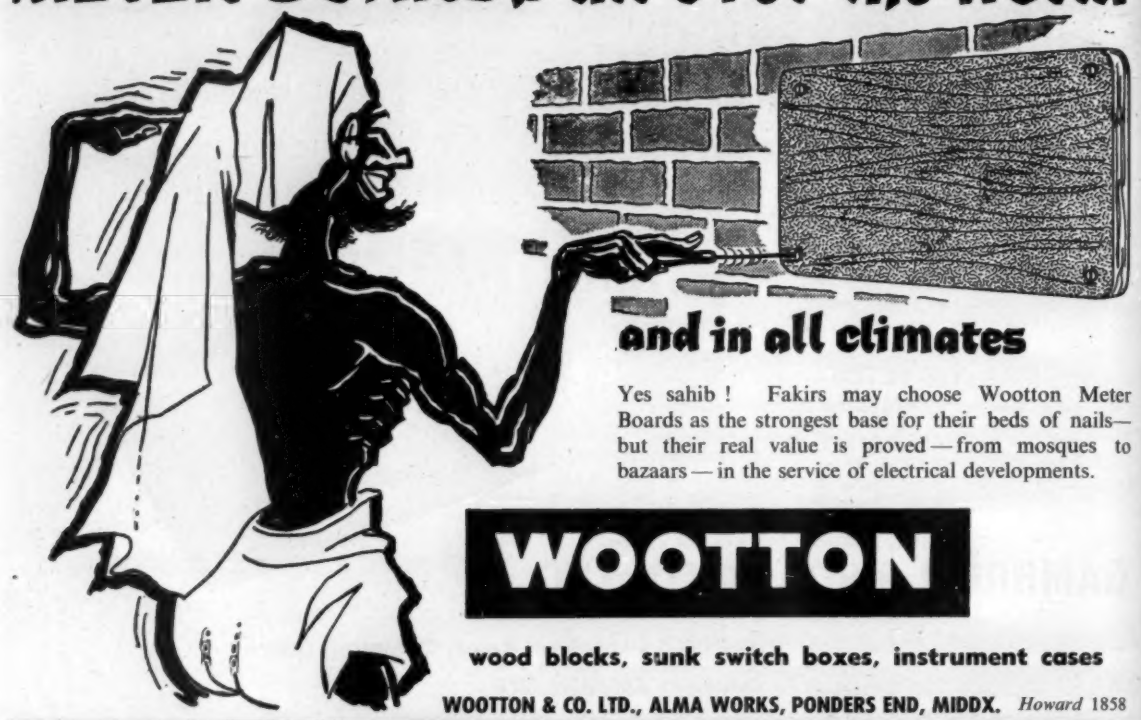

and in all climates

Yes sahib ! Fakirs may choose Wootton Meter Boards as the strongest base for their beds of nails—but their real value is proved—from mosques to bazaars—in the service of electrical developments.

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wood blocks, sunk switch boxes, instrument cases

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alloy 653

A new nickel-free Resistance Alloy, with Specific Resistance of 49 microhms/cm. cube. Recommended for heavy current resistors.

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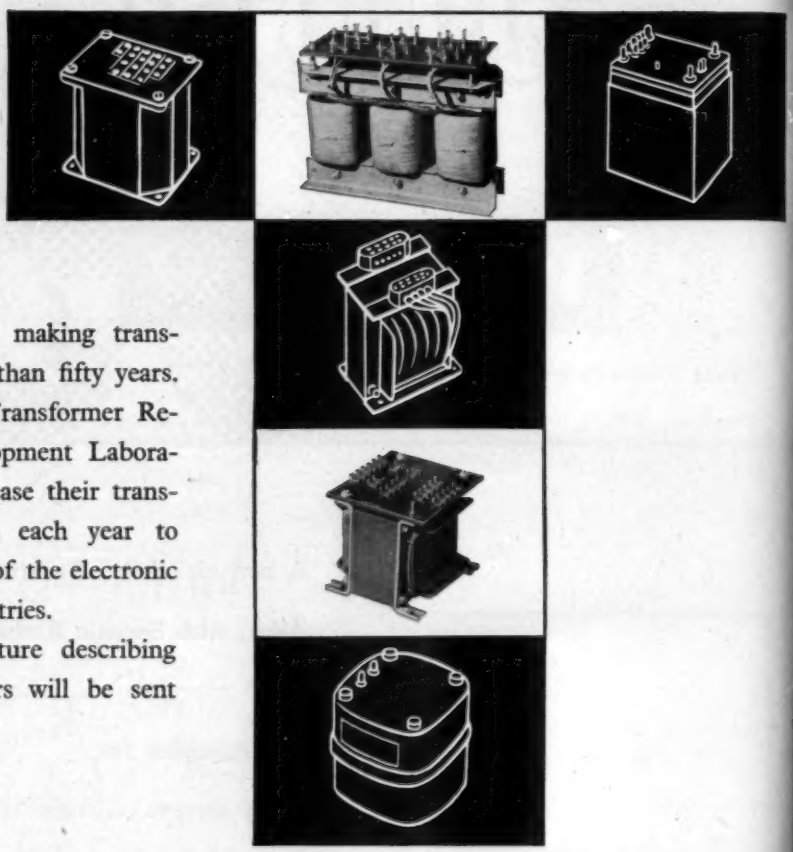
Transformers for Industry



S.T.C. have been making transformers for more than fifty years. Backed by their Transformer Research and Development Laboratories, S.T.C. increase their transformer production each year to meet the demands of the electronic and electrical industries.

A folder of literature describing S.T.C. transformers will be sent free on request.

specify S.T.C. transformers

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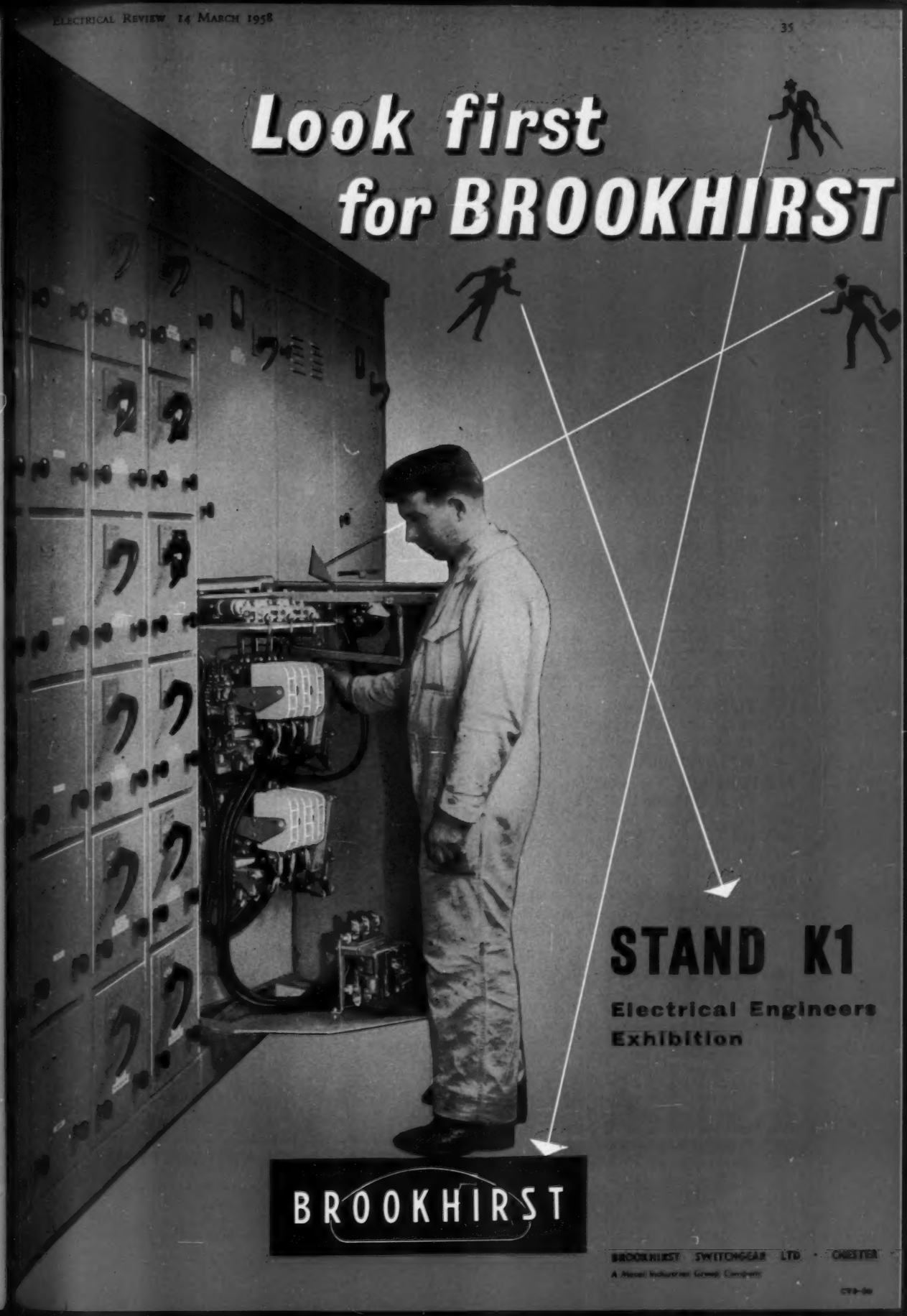

BROOKHIRST SWITCHGEAR LTD · CHESTER
A Member of the Hawker Siddeley Group

Visit us at Earls Court March 25-29th

ASTRAL ADAPTABLE BOXES

INTERIOR VIEW

British Made.
Patent Nos. 602,721 & 729,486

RANGE Thirty-five sizes of 'Astral' Adaptable Boxes. For conduit installations, and to enclose controls, switches, relays, test racks, terminals etc. Of unique strength, quality and utility. For each size of 'Astral' Box, three types of Steel Covers, each secured by four corner screws.

USE OF BOX	TYPE OF COVER	GAUGE OF COVER
SURFACE	'FLAT'	AS OF BOX
FLUSH	'FLAT OVERLAPPING'	14 B.G.
SURFACE, OUTDOOR OR DUSTY ATM. ETC.	'WEATHERPROOF' (Rubber Gasket)	16 B.G.

FEATURES Reinforced corners. Smooth inner and outer walls, of uniform thickness, facilitating drilling, threading, bushing, and fixing of attachments. No knockouts or holes. For heavy duty and reliable service.

MATERIALS Two small Boxes diecast in LM6 aluminium alloy, 3" x 3" x 1¾" deep and 2" deep. Thirty-three Boxes of formed sheet steel, 14 B.G. (0.078") for 4" x 4" x 2" deep to 6" x 4" x 4" deep, and 12 B.G. (0.099") for the larger Boxes up to 12" x 12" x 4" deep.

FINISHES All 'Astral' Adaptable Boxes and Covers are supplied stove enamelled black. Alternatively, the Steel Boxes and Covers up to 6" x 6" x 4" deep, can be supplied hot dip galvanized, and larger sizes zinc sprayed, or any size cadmium plated or Sherardized.

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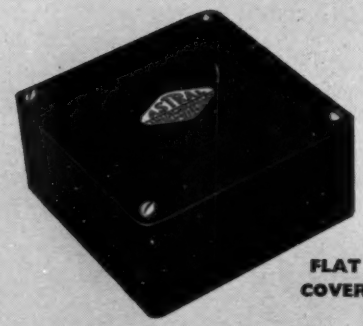

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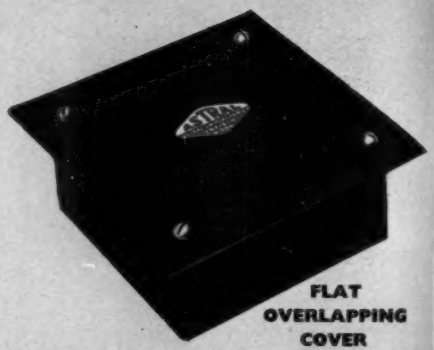
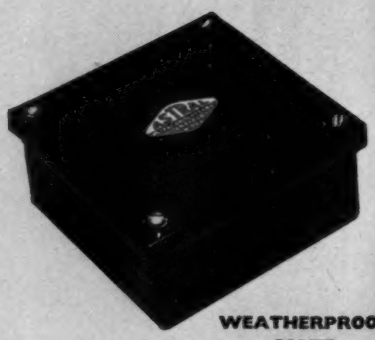


FLAT OVERLAPPING COVER



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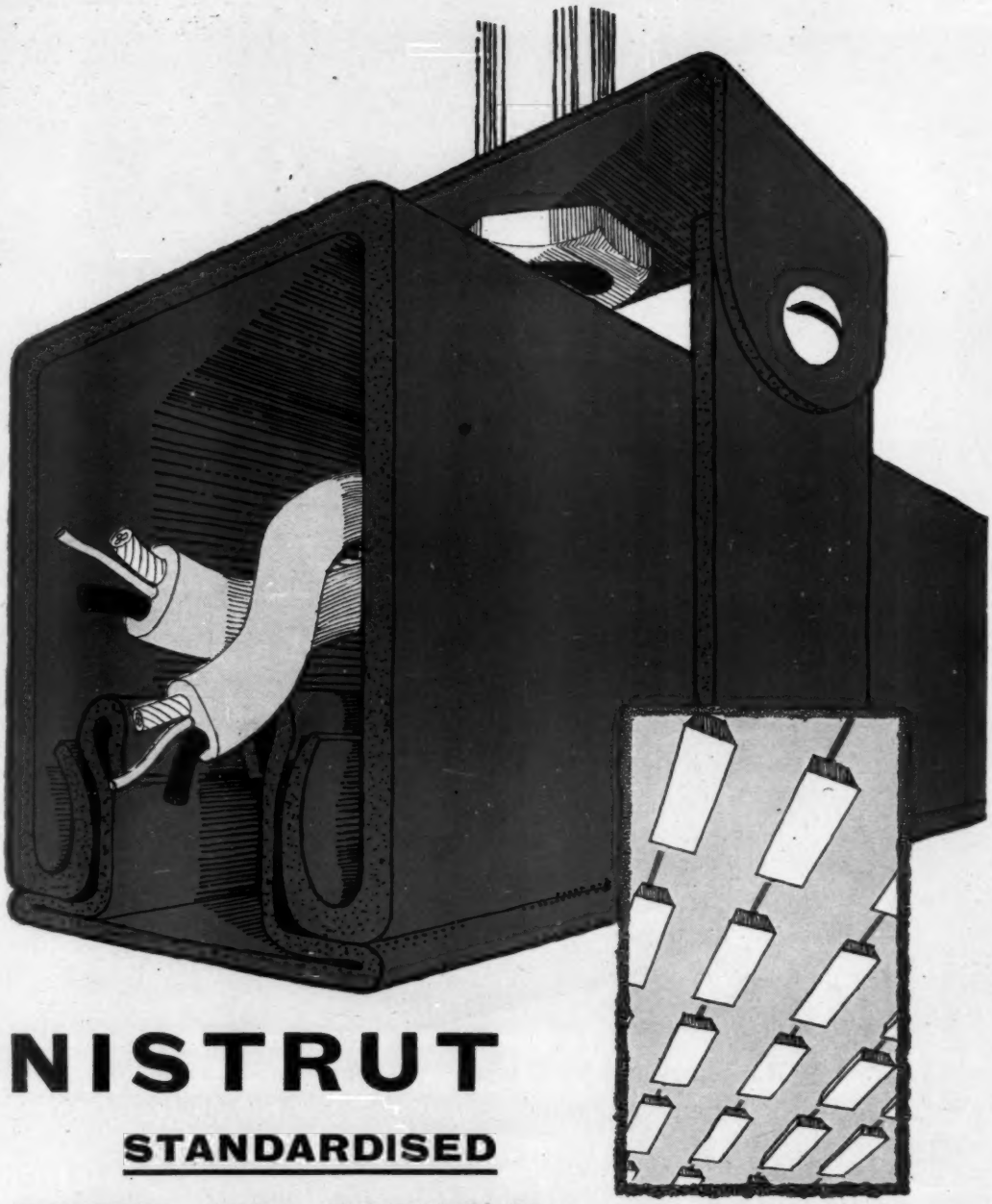

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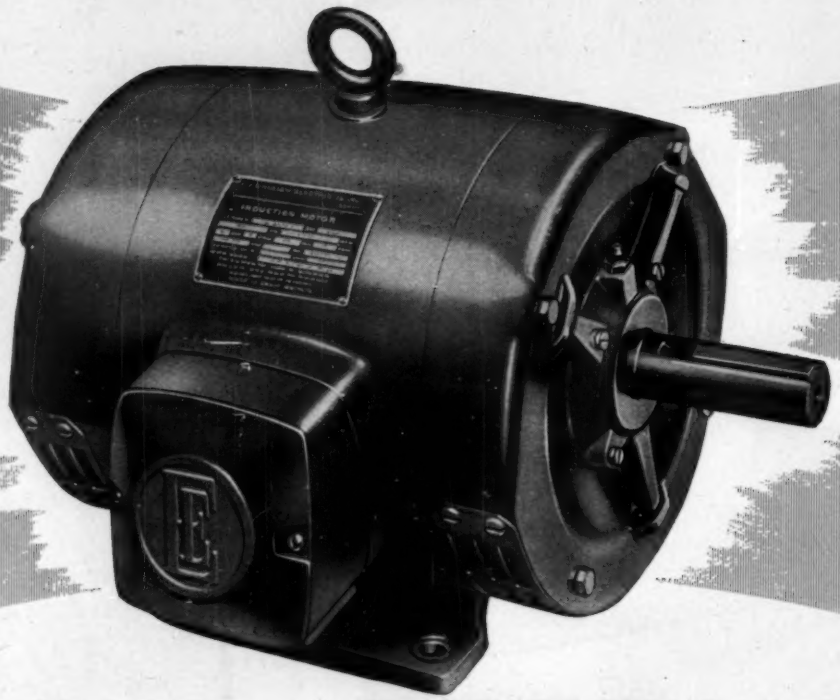

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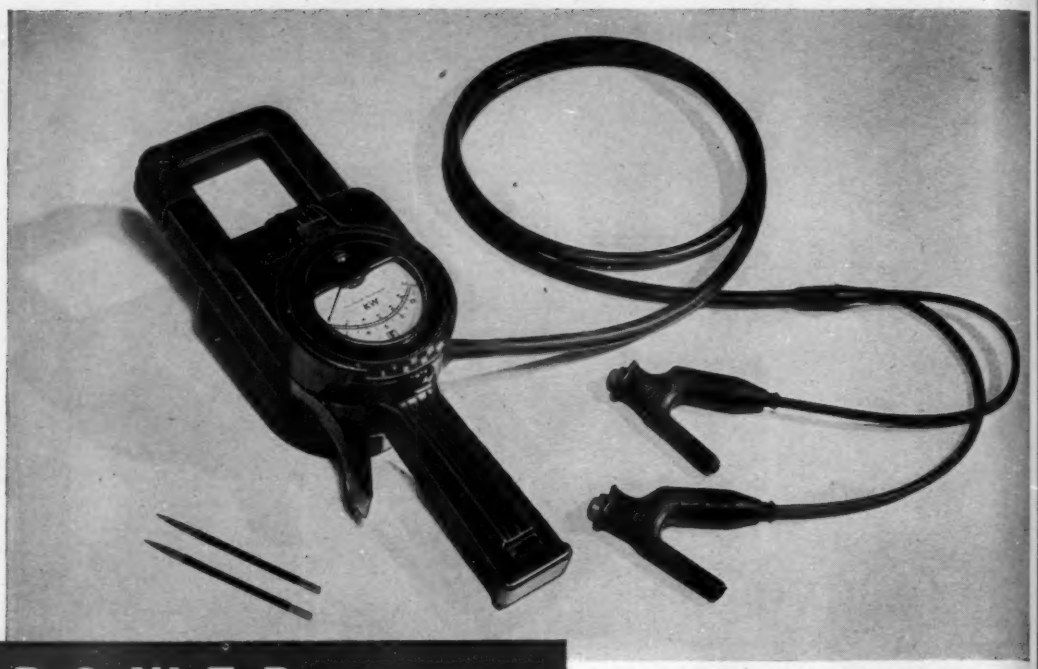

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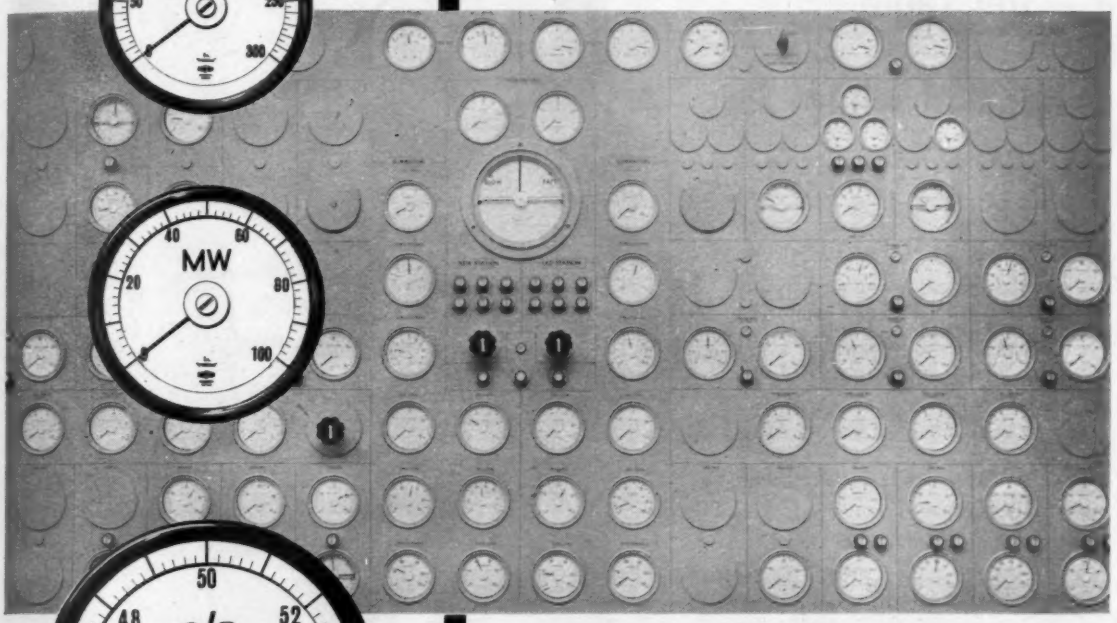

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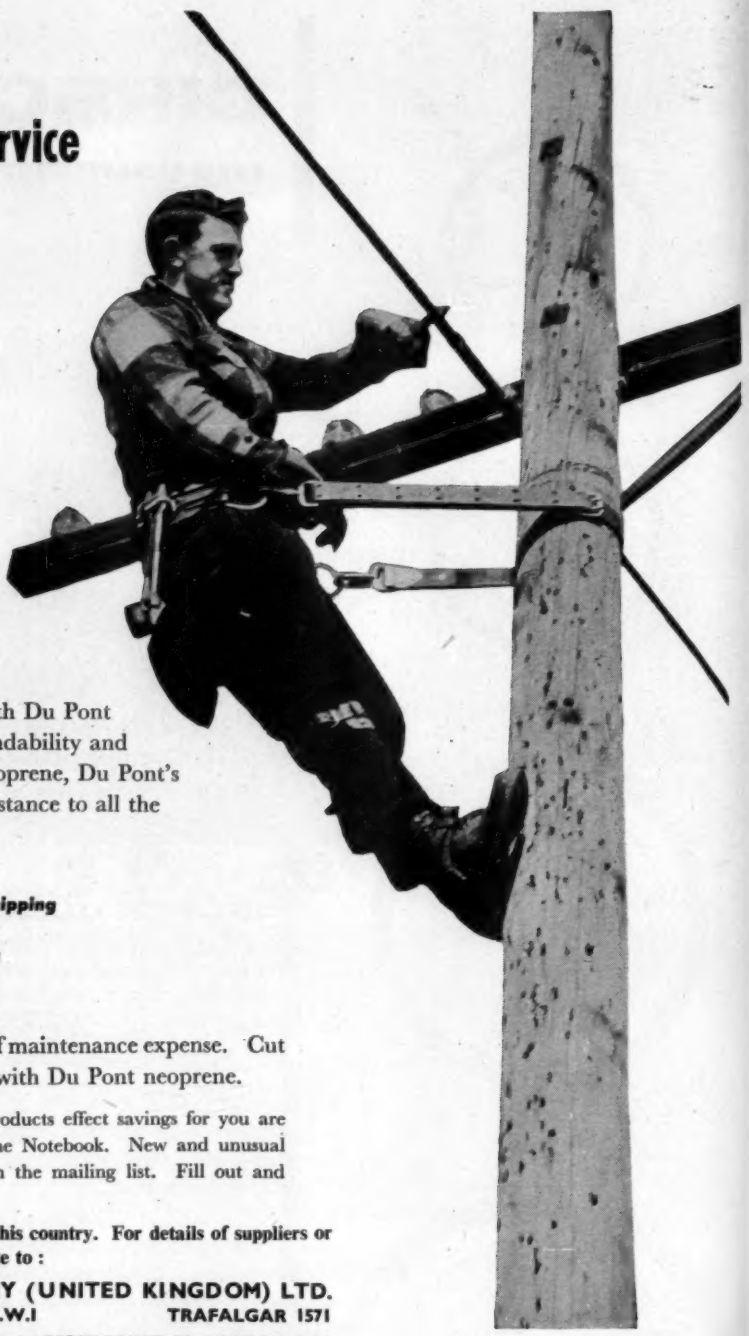

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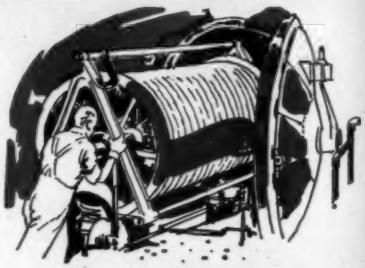

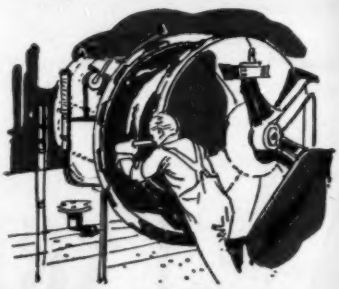

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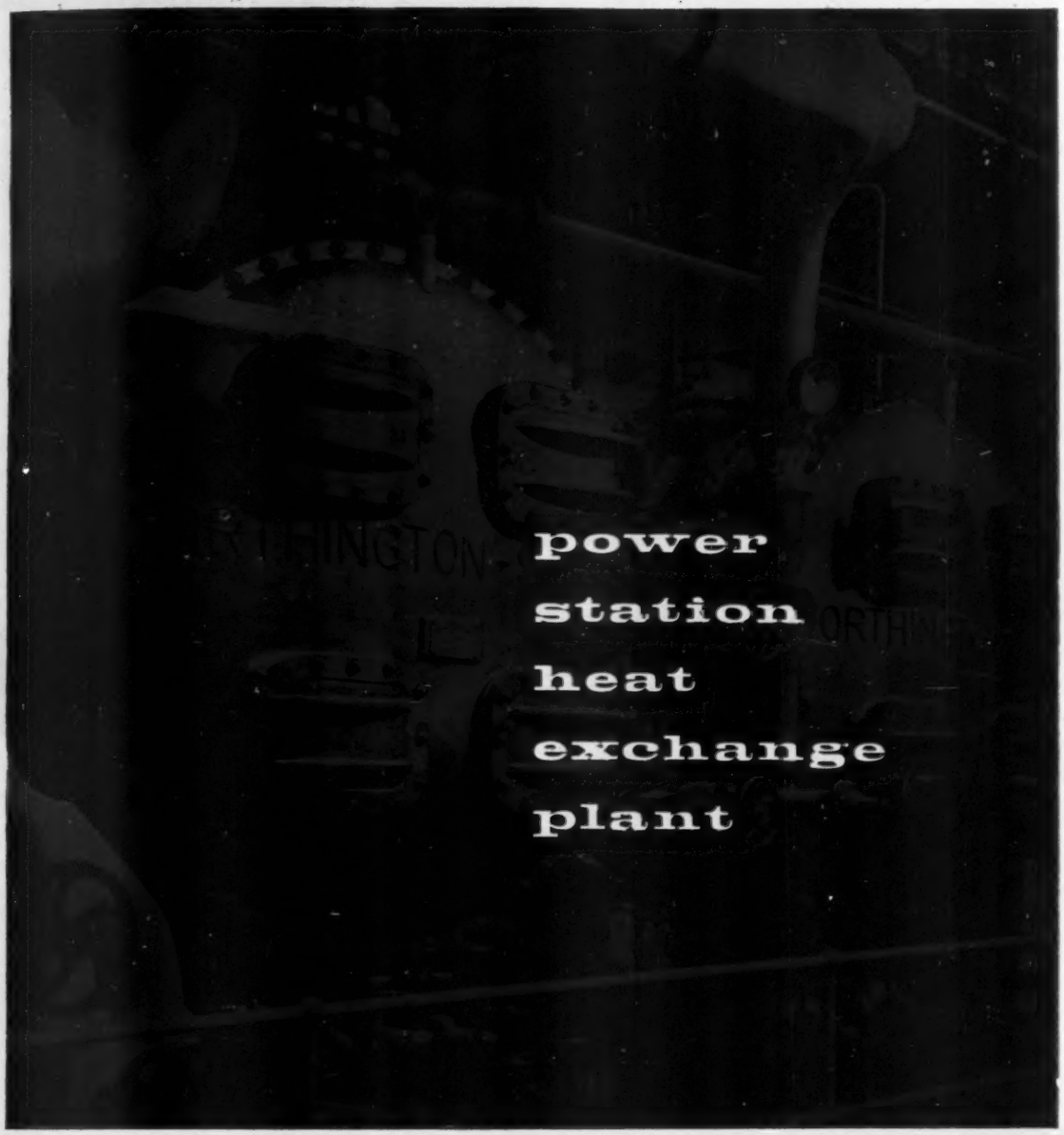

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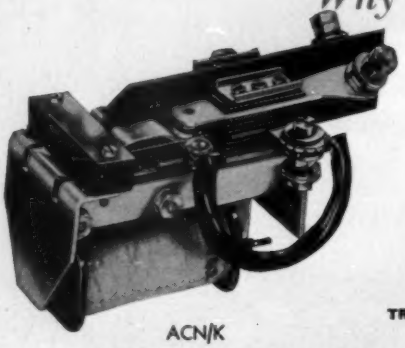

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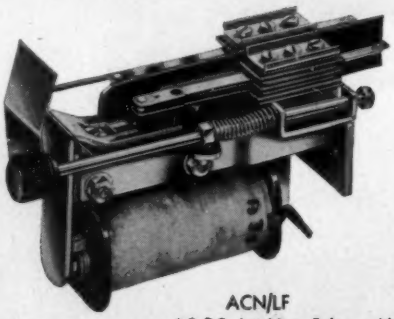

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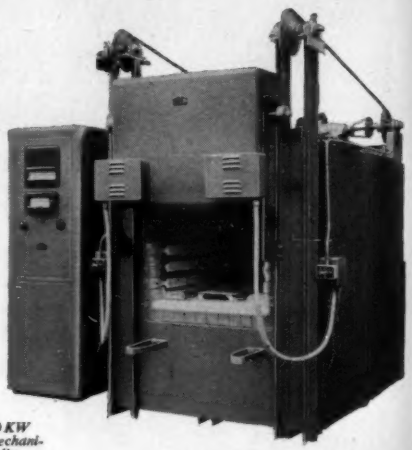

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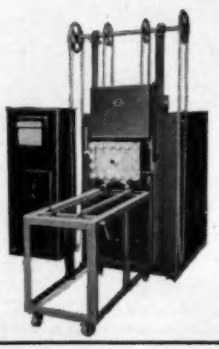

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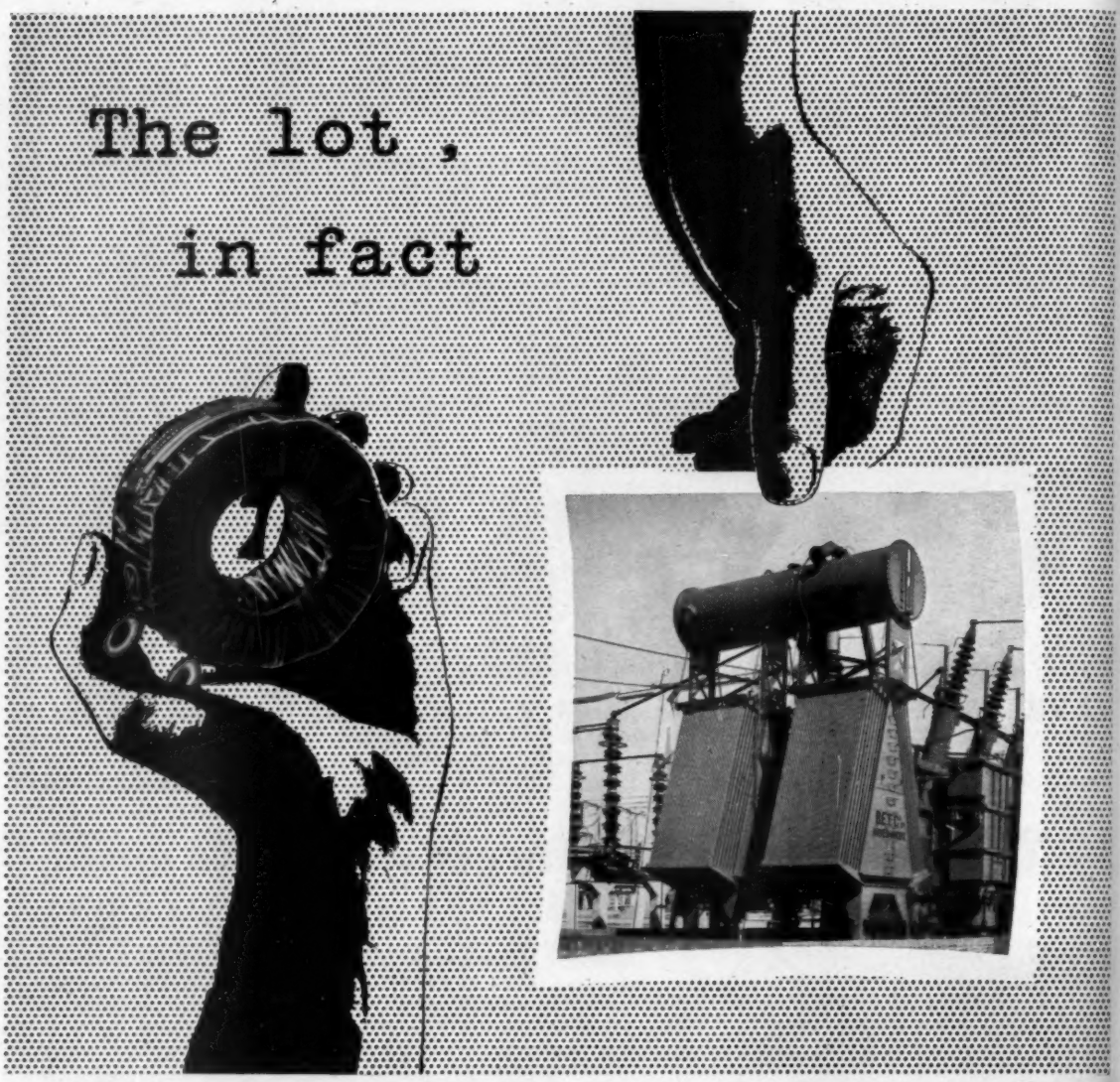

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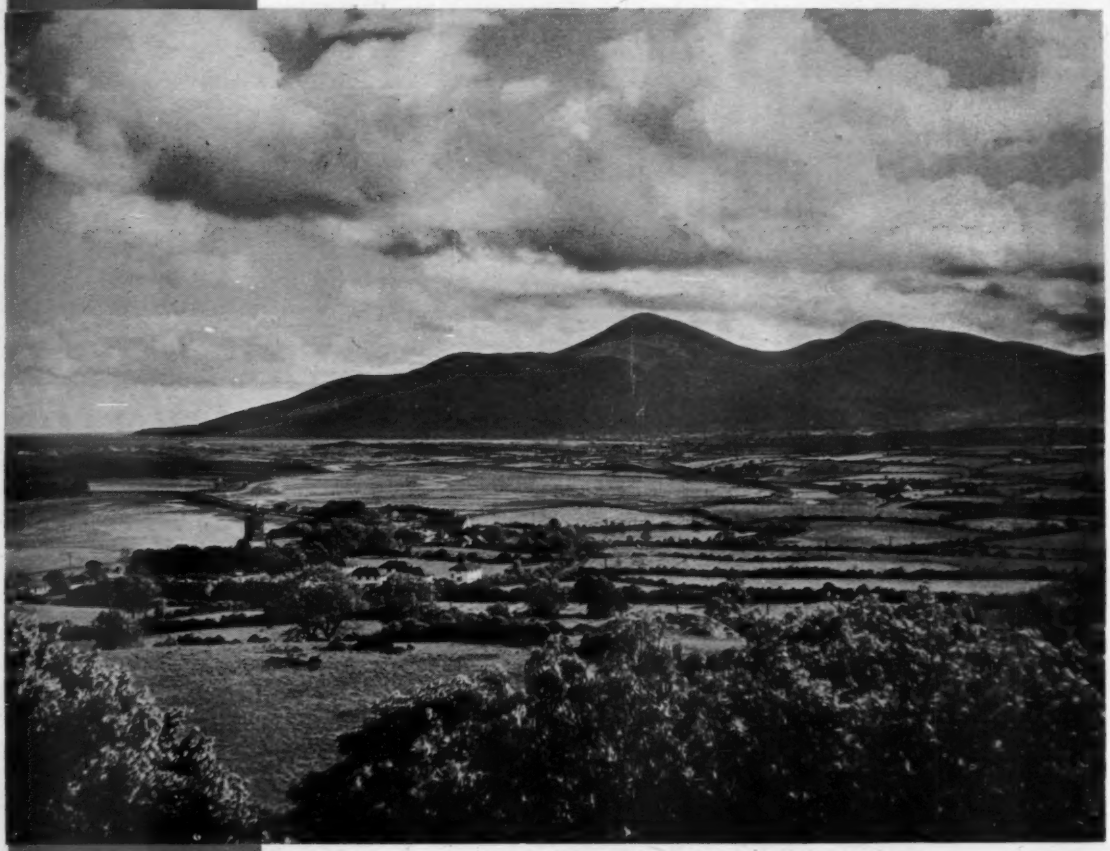

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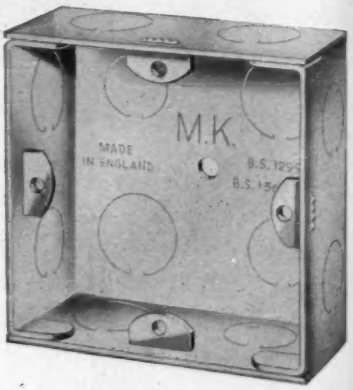

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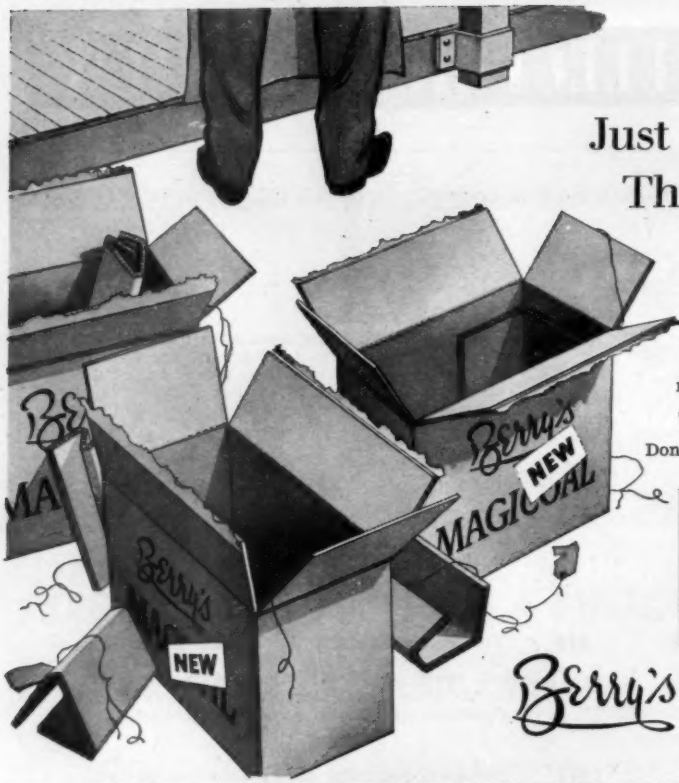

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14 March 1958 Vol. 162 No. 11 Established 1872

Problems of Nuclear Power

WITHIN the next few years the nuclear power stations which are at present being constructed for the Central Electricity Generating Board and the South of Scotland Electricity Board will be coming into commercial operation. Whereas electrical engineers in general have at least a basic idea of how conventional power stations are operated, it is unlikely that they can be familiar with the problems likely to arise from the operation of nuclear power stations. Many of the problems and much of the work will be the same as that encountered in conventional " fossil fuel " fired stations. There are problems peculiar to nuclear power plants, however, and although we have had a nuclear power station in operation in this country for nearly two years this is but a short time in the life of such a plant. According to the information which has so far been published, there is no doubt that Calder Hall has been remarkably successful both in its commissioning and subsequent operation and it is to be hoped that the civil power programme will follow the same course.

The article by Mr. G. T. Shepherd which appears in this issue creates a precedent in so far as the *Electrical Review* is concerned. It marks the first occasion on which we have published an article on the subject of nuclear power written by an engineer in the electricity supply industry. The article is intended to be of an introductory nature for those electrical engineers who are not intimately concerned with nuclear power, as such, and does not mention some of the more esoteric aspects of the subject. However, we venture to think that sufficient is said to indicate some of the operational ways in which the civil stations will differ from the Calder Hall prototype, which was designed primarily for the production of military plutonium.

Mr. Shepherd stresses the importance of attaining very much greater irradiations of the fuel than are obtained in the Calder Hall reactor. Do we detect an element of doubt here? The author does not imply scepticism, but one cannot avoid feeling that he is not entirely happy about either long irradiations or the method of on-load fuel changing which appears to be necessary. If this attitude does in fact exist, is it due to the excessive conservatism sometimes attributed to operating engineers or is it the natural caution that one would expect from people engaged in an industry whose first duty is to produce an adequate and reliable supply of electricity at an economic price?

It will be recalled that the civil nuclear power programme has been " re-phased," which is a euphemistic way of saying that it has been delayed slightly. This is due to the capital restrictions which the Government has recently imposed upon the supply

industry, but one cannot avoid wondering whether the nation is pressing ahead too rapidly before the early civil stations have proved themselves in service. On the other hand there is the question of whether we can afford not to forge ahead at a high rate when the supply industry doubles its fuel requirements every decade.

SCREW-THREAD PROBLEM

As a leading exporting nation we have taught a great many people all over the world to accept Whitworth Standard or British Association screw-threads as satisfactory for most purposes. But the influence of some other suppliers and the desire of some nations to decide themselves what they should have could well lead to confusion. It is manifestly uneconomic, if not impossible, to satisfy every demand and, as yet, there is no definite international standard to which British engineering concerns can adhere.

Manufacturers are consequently wondering how they can, in the meantime, meet the various demands of customers, fearing that if they do not attempt to do so they may lose business. They may seek an alternative to the British system which they think will satisfy the greatest number of overseas customers, but will they be wise to do so? The Council of the British Electrical and Allied Manufacturers' Association have had the matter under consideration for some time and in 1952 issued a policy statement recommending, in short, that there should be no departure from the British Standards except in special cases. That policy has now been reiterated with the proviso that when the final recommendations of the International Standards Organisation are available the matter can be reconsidered. But one major drawback is that the I.S.O. is not including the Whitworth threads in its review. British manufacturers would be ill-advised to make any change without first being assured that a new standard was universally acceptable.

POWER STATION MANAGEMENT

Has sufficient recognition been made of the great change which has taken place in the past two or three decades in the status of the electricity generating station? In earlier times with the electricity supply industry spread over something like 600 authorities, power stations were mainly quite small affairs by modern standards and the engineers in charge of them were essentially of the "practical" kind, i.e., they knew all about their plant and were able to keep it running efficiently according to their lights. How different are the modern super-stations with capacities now running up to 1,000 MW. The men in charge of these are necessarily of a quite different calibre although they still bear the title "station suprintendent" which, in a way, belittles them.

Discussing this and related questions in an article in the February *Electrical Power Engineer*, Mr. T. Allcock, Midland Area secretary of the E.P.E.A., says that the superintendent's job is becoming more and more managerial and, indeed, in stations above Class F in the N.J.B. classification, superintendents have been linked to the managerial agreement. Mr. Allcock suggests therefore that they should be called "power-station managers" and their deputies should be designated "deputy power-station managers." He also stresses the importance to-day of the mechanical engineers and the instrument engineers in power stations and, in general, he considers more generous grading to be desirable. At one time, he says, there were 3-4 men per MW; now the figure is down to 0·3 and so his proposals are not unrealistic.

HIGHWAYS AND PUBLIC LIGHTING

Towards the end of last year a symposium of papers was presented under the auspices of the Institution of Civil Engineers, London, on "Highways Needs of Great Britain." Reading through the papers we were surprised to be unable to find any references to public lighting, because over many years we had become accustomed to hear so much about the close relationship between public lighting and modern main road construction, particularly in respect of the prevention of road accidents.

We thought that this omission was so serious that we invited Mr. J. M. Waldram, a past-president of the Association of Public Lighting Engineers and a research worker in this field, to prepare an article on the subject for publication in the *Electrical Review*. This he has done and his comments are published elsewhere in this issue. We think the comments will do much towards inspiring road designers to give more attention to the ever-increasing importance of public lighting when they draw up their plans for main roads.

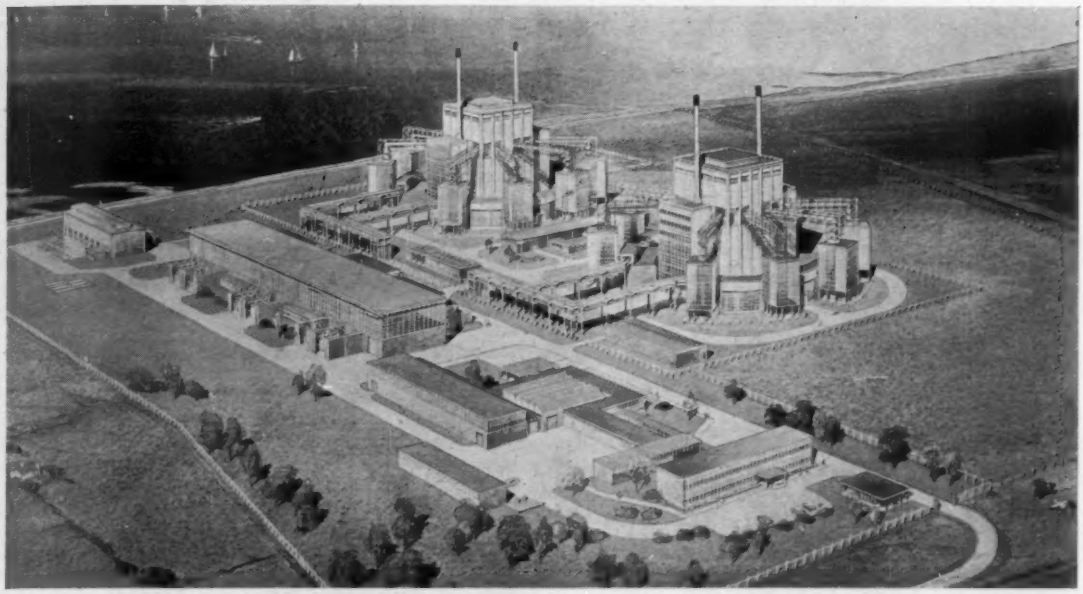
"CO-OPERATION" COMMITTEE

The names were announced on Monday of those appointed to the Ministry of Power's Committee to "consider ways in which by co-operation between the Area and Scottish Electricity and Gas Boards, in the performance of their respective statutory functions, the administration of the services of a like kind provided to the public by the two industries might be improved, and to make recommendations."

This Committee has been set up to satisfy a number of critics who believe that "co-operation" instead of competition between gas and electricity is desirable and would bring about economies and improvements. We have serious doubts about this, feeling that anything of the kind might put a brake on electrical development. We look to the electrical representatives on the Committee to ensure that nothing is recommended which will have that effect.

ELECTRICAL ENGINEERS' EXHIBITION

This year's Electrical Engineers' Exhibition, the seventh of its kind, is being held at Earls Court from Tuesday to Saturday, 25th to 29th March; more than 400 exhibitors — a record number — are taking part. An illustrated stand-by-stand preview of the Exhibition, which is to be officially opened by the President of the Board of Trade, Sir David Eccles, will appear in next week's *Electrical Review*



An artist's impression of the nuclear power station to be built at Berkeley, Gloucestershire, by the A.E.I.-John Thompson Nuclear Energy Co. The two reactors can be seen on the right and the turbine hall on the left

NUCLEAR POWER PLANT OPERATION

Problems Associated with Gas-Cooled Graphite-Moderated Natural Uranium Stations

By G. T. SHEPHERD, B.Sc.(Eng.), A.M.I.Mech.E., A.M.I.E.E.*

THE operational problems of nuclear power stations fall into two main categories: those common to both fossil fuel fired and nuclear plants and those peculiar to nuclear plants. This article is limited to the second case and is further restricted to the gas-cooled graphite-moderated natural uranium stations now building and to be built in the near future for the Central Electricity Generating Board. Many, if not all, operational problems have their influence on design, and some relevant design criteria are mentioned.

Running Costs

Operational problems are all involved in the general objective of producing electricity safely at the cheapest price with a given design. This, of course, embraces a number of factors, the two most important being low fuel cost and high annual load factor. Safety, of course, is of paramount importance, but covers a wide field and is not considered here in any detail. Other factors are maintenance and operation, salaries and wages, stores, oil and water, etc.

To obtain a low fuel cost, the first requirement is to achieve a high average irradiation of the uranium. It is perhaps as well at this stage to remind readers that fuel irradiations are usually expressed in terms of megawatt days per tonne (MWD/tonne). Whenever this terminology is used, it is important to remember that the energy is expressed in heat megawatts and not electrical megawatts. Thus if we refer to a tonne of uranium releasing under irradiation, say, 2,000 MWD of energy, we must multiply this figure by the overall station thermal efficiency in order to obtain the equivalent electrical energy. The unit of weight used, the tonne, is particularly useful since 1 tonne=1,000 kg, and hence 1 tonne of natural uranium contains 7 kg of U235 (0·7 per cent). Incidentally, since 1 tonne$=\frac{10^6}{454}$ lb=2,203 lb, it is close enough to a ton for most practical purposes.

Fig. 1 shows quite clearly that to produce economic nuclear power in gas-cooled reactors of about 250 MW (electrical) output, it is necessary that the fuel in a reactor should be irradiated to an average level of at least 2,000 MWD/tonne. So far as is known, all existing natural uranium reactors have been operated either for special purposes (materials testing, isotope production, prototype testing, etc.) or, in the case of large reactors, for the production of military plutonium. In reactors producing military plutonium it is necessary to remove the fuel after relatively low irradiation periods to avoid production of unwanted isotopes of plutonium such as Pu240, etc. Very few natural uranium fuel elements have therefore yet been irradiated under working conditions to anywhere near the 2,000 MWD/tonne figure. Research and development work on both the nuclear and metallurgical aspects of fuel elements shows that no great difficulty should be experienced in reaching the required range but, as in all such matters, this can only be proved in practice.

Fuel Cycles

The shape of the neutron flux distribution in a nuclear reactor is approximately of cosine form both axially and

* Nuclear Services Engineer (Operations), Central Electricity Generating Board.

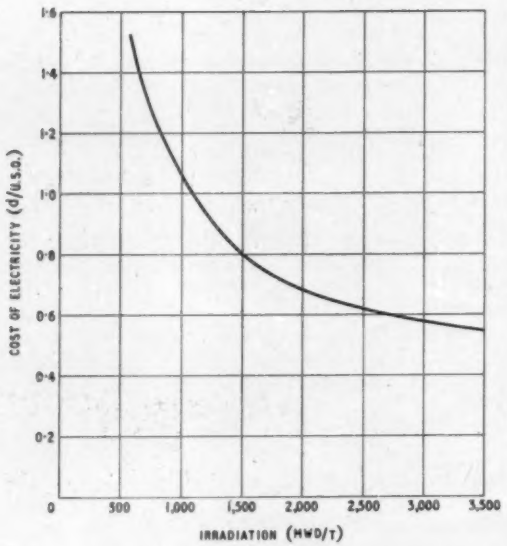


Fig. 1.—Estimated cost of electricity with varying irradiations of fuel for early C.E.G.B. stations

diametrically. Since both heat production and irradiation of a fuel element are proportional to the neutron flux at its position in the reactor, it is obvious that if the whole fuel charge were to be changed at one time, some elements would undergo extremely high irradiation whilst others would receive hardly any. It follows, therefore, that to achieve a high average irradiation without any of the fuel undergoing severe irradiation, it is desirable either to divide the reactor core into zones and employ a zonal discharge or, ideally, remove and replace each fuel element as it achieves its desired irradiation. Both methods would mean, of course, that fuel elements in the centre of the reactor would be replaced much more frequently than those in the outer zones. The latter method implies on-load fuel changing, but the former method could be performed with the reactor shut down. Even in this case, however, the reactor would have to be taken out of service for such periods as to reduce seriously the annual load factor. In such circumstances, nuclear power, with its high capital cost, would be uneconomical at the present time.

The ratio of the number of neutrons being produced in a nuclear reactor to the number produced in the previous generation is known as the effective reproduction constant, usually denoted by k or k_{eff}. For steady load said to be convergent if k_{eff} is less than unity and divergent conditions, this must obviously be unity, the reactor being if k_{eff} is greater than unity.

Reactivity, ρ, is then defined by the equation:—

$$\rho = \frac{k_{eff} - 1}{k_{eff}}$$

Thus, under steady load conditions, the reactivity is zero.

It is clear that to be able to control a reactor, excess reactivity has to be built into it, this excess reactivity being absorbed by neutron-absorbing control rods or other means. Not only is this excess reactivity necessary for control, but Fig. 2 shows that the reactivity available varies with time. This variation is not known exactly, but is a relatively long-term effect. First, there is a drop due to the build-up of samarium among the fission products, this being a strong neutron absorber. This soon builds up to a steady value and the reactivity then rises due to the production of plutonium 239 which, of course, is a fissile fuel. In time, further isotopes of plutonium are produced (particularly Pu240 which is relatively non-fissile) and the available reactivity falls. Due to the shape of the reactivity curve for any fuel element being as shown in Fig. 2, the limiting irradiation possible for the reactor as a whole from a nuclear physics aspect occurs when each fuel element is irradiated for time T such that the areas above and below the zero reactivity axis are equal. This concept again leads one to the principle of continually replacing fuel elements such that while elements are distributed evenly along the reactivity line, the average reactivity of the reactor remains constant and positive.

For these reasons, considerable gains can be obtained in power producing reactors by introducing a form of on-load fuel changing. Such a scheme approaches closely to continuous fuel charging by changing one channel at a time, about three channels per day being the normal rate. An even closer approach to equal irradiations can be made by transposing the fuel elements in a given channel, as shown in Fig. 3, between the fuel changing. It is also possible to increase the average irradiation slightly by changing complete channels radially, but the procedure becomes rather complicated. This, together with the considerable mechanical handling of the fuel elements required, makes the value of such an extension of an on-load charging scheme marginal.

Should the metal can of a fuel element become perforated under irradiation then the offending element must be removed from the reactor. If a cartridge became perforated and were not removed, fission products and possibly uranium dust would be carried around the external circuit contaminating the boilers, ductwork, etc., and thus making maintenance more difficult. Far more important, active dust would be carried forward and deposited in the reactor in the healthy channels. This would have the effect of reducing the sensitivity of the burst cartridge detection gear generally and hence delay the notification and location of any further can failures. Thus in time the reactor might become inoperable. Although the term "burst cartridge detection gear" is now in common use, it should be realised that the type of "burst" expected, and so far encountered in nuclear reactors, is not only uncommon but usually so small as to render the fault invisible to the naked eye.

On-load charge and discharge equipment therefore also has the valuable side asset of being able to deal expeditiously with any burst cartridges without the necessity of shutting down the reactor, reducing its gas pressure to zero, discharging the affected channel, repressurising and bringing the plant on line again, all of which might take up to twenty-four hours to complete, involving outage of valuable low running cost plant.

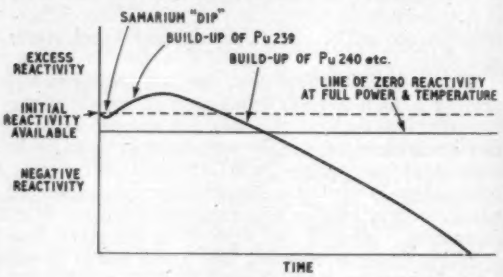


Fig. 2.—Long-term variation of reactivity with time

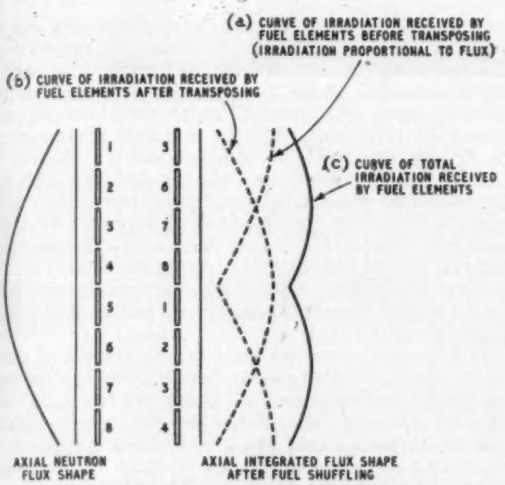

(a) CURVE OF IRRADIATION RECEIVED BY FUEL ELEMENTS BEFORE TRANSPOSING (IRRADIATION PROPORTIONAL TO FLUX)
(b) CURVE OF IRRADIATION RECEIVED BY FUEL ELEMENTS AFTER TRANSPOSING
(c) CURVE OF TOTAL IRRADIATION RECEIVED BY FUEL ELEMENTS
1 2 3 4 5 6 7 8
5 6 7 8 1 2 3 4
AXIAL NEUTRON FLUX SHAPE
AXIAL INTEGRATED FLUX SHAPE AFTER FUEL SHUFFLING

Fig. 3. — Effect of transposing fuel elements within a channel upon average and maximum irradiations

For the above reasons, on-load charge and discharge systems have been developed for the British civil nuclear power stations. The difficulties of both designing and maintaining such equipment should, however, not be minimised. The basic problems are as follows:—

(1) Fuel elements must be introduced into the reactor graphite core, these elements when so introduced being surrounded by hot carbon-dioxide gas at a pressure of several atmospheres, there being about a dozen elements in each vertical channel through the core.

(2) Irradiated and highly active elements have to be removed from the reactor under similar circumstances to (1).

(3) Whilst an element is being introduced to or removed from a channel, the channel cooling flow of CO_2 must be maintained in order to avoid overheating of the other elements in that channel.

(4) Since an irradiated cartridge, on removal from the reactor, is being heated internally by fission product action, it must be continually cooled whilst in the discharge machine. This cooling must not fail in any circumstances.

(5) If any cartridges "burst" under irradiation, they will have to be discharged and the discharge machine will become contaminated internally, possibly giving rise to difficult maintenance problems.

(6) The fuel elements consist of uranium, canned in a magnesium alloy, and therefore cannot be subjected to heavy handling or excessive thermal shock.

(7) The ingress of any foreign materials to the reactor must be avoided. These include, for example, argon which is normally present in the atmosphere.

(8) The equipment must be adequately shielded to protect operators from the effects of gamma and neutron radiation at all stages of operation.

(9) Despite large differential expansions under working conditions, it is necessary that a discharge or charge machine should be able to locate any fuel channel accurately. The main problem involved here is that it is not practicable, for mechanical reasons, to arrange for a hole through the pressure vessel for each channel, and hence one charge hole has to serve many channels.

It will be seen, therefore, that the difficulties are formidable, but equipment has been designed which should overcome such difficulties and large savings should accrue by its installation. The development of on-load charge and discharge machines is the biggest single development from Calder Hall to the early civil stations, but it should be emphasised that Calder Hall, with its different purpose, does not require such equipment. In view of their complications, it would be unreasonable to expect that these machines will not have teething troubles. Arrangements have been made, therefore, for the machines to be completed well before the commissioning date in order to carry out exhaustive testing and the training of operators; in addition, a dummy section of the reactor containing fuel channels will be provided adjacent to each reactor for these purposes. The machines will also be used to load a considerable part of the initial fuel charge, although time considerations dictate that some of this operation will be carried out by hand loading or its equivalent. Fig. 4 shows an example of a combined charge and discharge machine which has been developed by the Nuclear Power Plant Co. for Bradwell power station. It is 50ft high and weighs about 200 tons. Most of this weight is taken up by shielding which is easily removable for maintenance purposes. The machine has also been designed so that individual mechanisms can be replaced as separate units in order to facilitate maintenance on a routine basis.

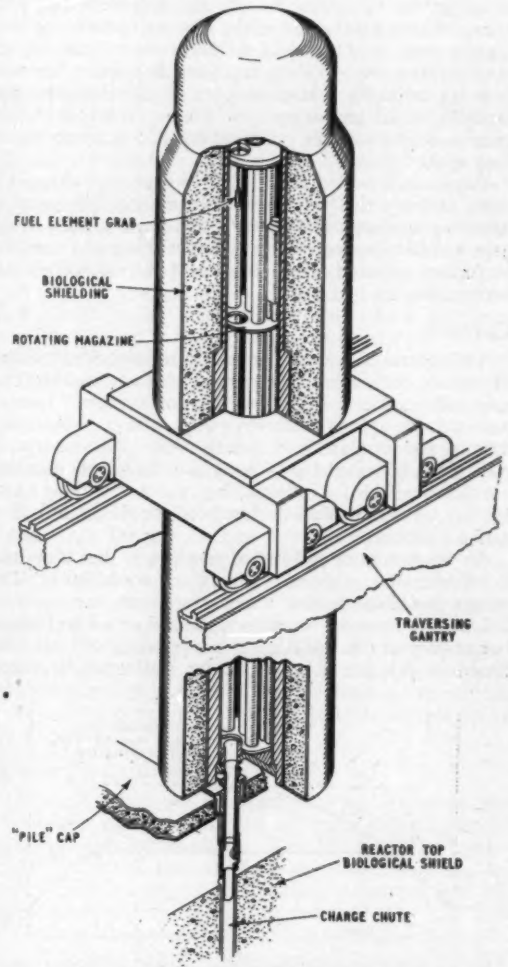


Fig. 4.—General arrangement of on-load charge and discharge machine by the Nuclear Power Plant Co., Ltd.

As previously mentioned, the normal diametral neutron flux distribution is of approximately cosine shape and is shown by curve (a) in Fig. 5. The highest rated channel occurs at the centre of the reactor and the heat output of the reactor is proportional to the area under the flux curve (to a first approximation). If the reactor has sufficient excess reactivity available this can be utilised to give greater heat output by "flattening" the neutron flux. This is done by inserting neutron absorbers into the centre region. The flux is then diminished, ideally as shown in Fig. 5, curve (b). Withdrawal of the control rods then increases the flux to its original maximum value with a consequent increase of heat output. It is also possible to flatten the flux by introducing enriched fuel into the outer region. Due to point reactivity changes which take place with time, as shown in Fig. 2, and to the partial intrusion of control rods, the neutron flux distribution changes with time and it will probably be necessary to insert and remove neutron absorbers during operation.

During operation it will be necessary to take frequent measurements of fuel element temperatures and the neutron flux pattern throughout the reactor. These are important in order to assess the irradiation periods of individual fuel elements and also to ensure that no elements are being overheated; the maximum can temperature allowable is one of the limiting factors in power output, and it is essential to know where the highest temperatures are occurring and what they are. Provision is being made for a large number of the elements, particularly in the high-temperature zone, to be fitted with thermocouples for this purpose, but this is by no means easy to do.

Gags are provided at the inlet to each fuel channel in order to vary the gas flow across the reactor so as to achieve a sensibly uniform gas outlet temperature. These gags will be adjusted during commissioning and can later be further adjusted, if required, with the reactor on load whilst changing fuel.

Control

The control of thermal reactors is traditionally by means of control rods, these containing high neutron-absorbing materials such as boron in one form or another. Control rods may be split into three groups, fine control, coarse control and emergency or safety rods. The emergency rods are kept raised even during shut-down, so that they are then available for use should excess reactivity be added by, say, the removal of depleted fuel or the falling-off of xenon poisoning.

An advantage of gas-cooled reactors is that they have a substantially negative temperature coefficient. This means that if the reactor temperature rises, the reactivity falls and the reactor becomes stabilised at a lower power but at very nearly the original temperature. It has been found in practice that the Calder Hall type of reactor behaves so well in this respect that power output can be controlled by varying the gas flow only: the control rods are used mainly to trim the gas outlet temperature, adjust the neutron flux shape as required and, of course, for shutting down the reactor under both normal and emergency conditions. Thus, if a reactor is assumed to be running under steady conditions and it is desired to increase load, the gas blowers are speeded up. This has the immediate effect of reducing reactor temperatures due to the increased gas mass flow and the reactivity therefore increases. Hence the reactor heat output is increased and the reactor temperatures return very closely to the original conditions. Such behaviour makes the gas-cooled reactor very simple to operate and gives it a high degree of safety.

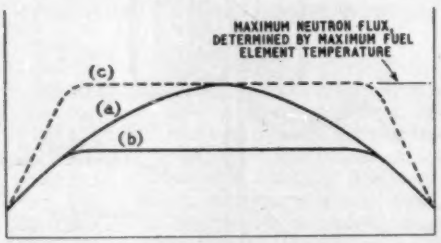


Fig. 5.—Radial neutron flux in nuclear reactors: (a) Normal radial flux distribution; (b) Curve A flattened—heat output reduced; (c) Flattened flux curve—heat output raised to limit

In a nuclear power station a certain amount of automatic control is desirable as between the reactor and associated turbo-generators. There are basically two ways of achieving this. Either the plant can be run so that the turbines accept whatever steam is generated by the reactor boilers, or the reactor produces the necessary heat required by the turbines. The former system is employed at Calder Hall and has the virtue that reactor conditions can be maintained constant during changes of system frequency and hence thermal cycling of fuel elements kept to the minimum. Such a system, however, has no stabilising effect upon the grid system in the event of a serious fall of frequency due to a sudden loss of generating or transmission capacity elsewhere on the system. With a very large integrated system such as in Great Britain, there can be no objection to relatively small blocks of power operating under such conditions, but with the large civil stations due to come into operation in the next few years, this system could not be tolerated. It is estimated that on the British grid system, over 90 per cent of generating capacity lost under fault conditions is recovered immediately by governor response on the remainder of the running plant on the system. Thus, if the "reactor controlling turbine" control system were used to any large extent, there would be grave danger of system collapse under fault conditions.

In the C.E.G.B. power stations, therefore, control systems similar to conventional practice will be used. Recent work has shown that any resultant variations in fuel element temperatures will be very small and need no longer be a restriction upon the type of control to be adopted. It is possible, therefore, to arrange for the reactor to be automatically controlled to maintain correct steam conditions as in the case of conventional power station boiler plant. A complication in this method is that, since these stations all use a double-pressure steam cycle, each turbine has two sets of governor valves, h.p. and l.p. This means either that two adjustments have to be made to every turbine for every one on conventional plant or that an attempt has to be made to link the two sets of governor valves together so as to follow the reactor/boiler unit characteristics. Even in this case, some form of trimming is probably necessary on, say, the l.p. governor system.

Dump condensers of 100 per cent reactor capacity were provided at Calder Hall for three reasons: first, to allow a reactor to be commissioned and tests carried out without the complication of having to run and load the associated turbo-generators; second, to be able to remove reactor shut-down heat without blowing steam to atmosphere for long periods; and third, since Calder Hall is primarily a military plutonium producer, to enable the reactors to run at full output with some or all of the generating plant out of commission. In the C.E.G.B. stations, however, the third point does not arise and it becomes possible to

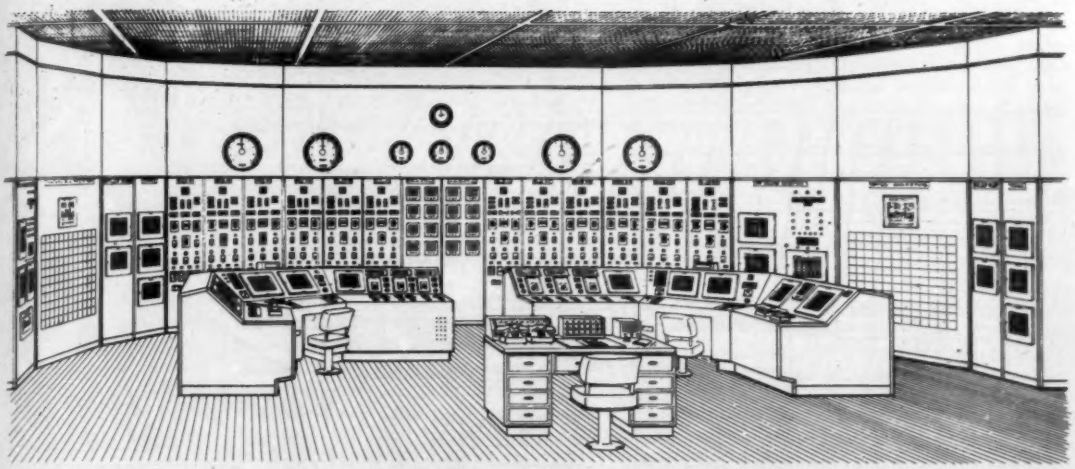


Fig. 6.—General arrangement of control room for Hinkley Point nuclear power station

reduce the size of the dump condensers considerably. The C.E.G.B. stations will each have two dump condensers, each of about 10 per cent reactor output. This will enable the fission product heating (or shut-down heat) of the two reactors to be removed in one condenser in the event of the complete loss of the generating plant and also allow the first reactor to be brought up to 20 per cent load without running the turbines.

In the interests of greater operational efficiency and supervision, central control rooms will be used in the C.E.G.B. nuclear stations. A typical layout is shown in Fig. 6 and it will be seen that the control room is under the supervision of a control room engineer as in conventional power stations. In addition, there will be reactor control operators, each controlling one reactor and its associated turbo-generators. It will be of interest that on the boiler panels, for example, there will be provided such instrumentation as steam pressures and temperatures, feed flow, water levels and electrical control of feed check valves. Here, perhaps, it should be noted that steam interconnection between the two halves of a station equal to one turbo-generator set capacity will be provided and it is expected that the stations will be operated for the most part on the " range " principle.

Maintenance

The turbine room maintenance of a nuclear power station is virtually identical with that for a conventional power station, as is the bulk of the electrical maintenance, and calls for no comment here.

The big problem, of course, is the reactor. Here we have a large pressure vessel that cannot be visually inspected in the normal way primarily because of the high gamma activity arising from the irradiated cobalt present in the pressure vessel steel. The safety of the pressure vessel is assured by conservative design and strict attention to fabrication and testing. Even so, few managers, who are responsible for the safety of their plant, would be completely satisfied with this unless further inspection or testing proved impossible. Limited inspection can be carried out through reactor charge holes, etc., using television cameras and introscopes and a very high degree of illumination. Another aid is the insertion in the reactor of test-pieces of pressure vessel steel, these being submitted to similar or more severe conditions of stress, irradiation, temperature, etc., than the actual vessel steel. These test-pieces can be withdrawn as required for examination. Ancillary plant requiring special maintenance techniques will be the charge and discharge equipment and control rod mechanisms; these, in general, can be maintained without shutting down the reactor.

The only other parts of the plant calling for notice here are the gas ducting and boilers. The ducting is of the order of 5ft diameter and contains isolating valves and corrugated expansion pieces. These latter have by their very nature, highly stressed convolutions which will require strict inspection, whilst the boilers or heat exchangers are " boilers " within the meaning of the Factories Acts and, therefore, are subject to statutory inspection. For both safety and convenience it is proposed that the boilers shall be inspected with the complete reactor/boilers unit shut down and depressurised. Active dust inside the boilers may be a nuisance in inspection, but one that can be overcome. It would not be good practice to isolate a single boiler by means of the gas valves and then send personnel inside the gas space, since this would mean that reliance was being placed on the tightness and security of one valve between the working space and hot active carbon-dioxide under pressure. Blanks are therefore being provided so that they can be inserted into the gas circuits on the boiler side of the valves. These are not intended for routine inspection, during which the whole of the reactor/boiler unit will be shut down, because of its size and weight, but rather so that major maintenance can be carried out on an individual boiler and gas blower circuit with the remaining circuits in operation. It will be appreciated that nuclear boilers, as used in gas-cooled reactor stations, are subject to far less onerous conditions than their conventional counterparts.

Nuclear Radiations

The only radiations of importance to operation are neutron and gamma radiations, the more difficult one to shield against being the latter. This is because the carbon dioxide circulating around the reactor and boilers has an activity from the argon 41, oxygen 19 and nitrogen 16 present after passing through the reactor. Much of this activity is quite short-lived* but, due to the short time of gas circulation, the gas is active around the whole circuit whilst the plant is running. As the capacities of nuclear

* The half life of A_{41} is 1·8 hr, that of O_{19} 29 sec, and N_{16}, 7·3 sec.

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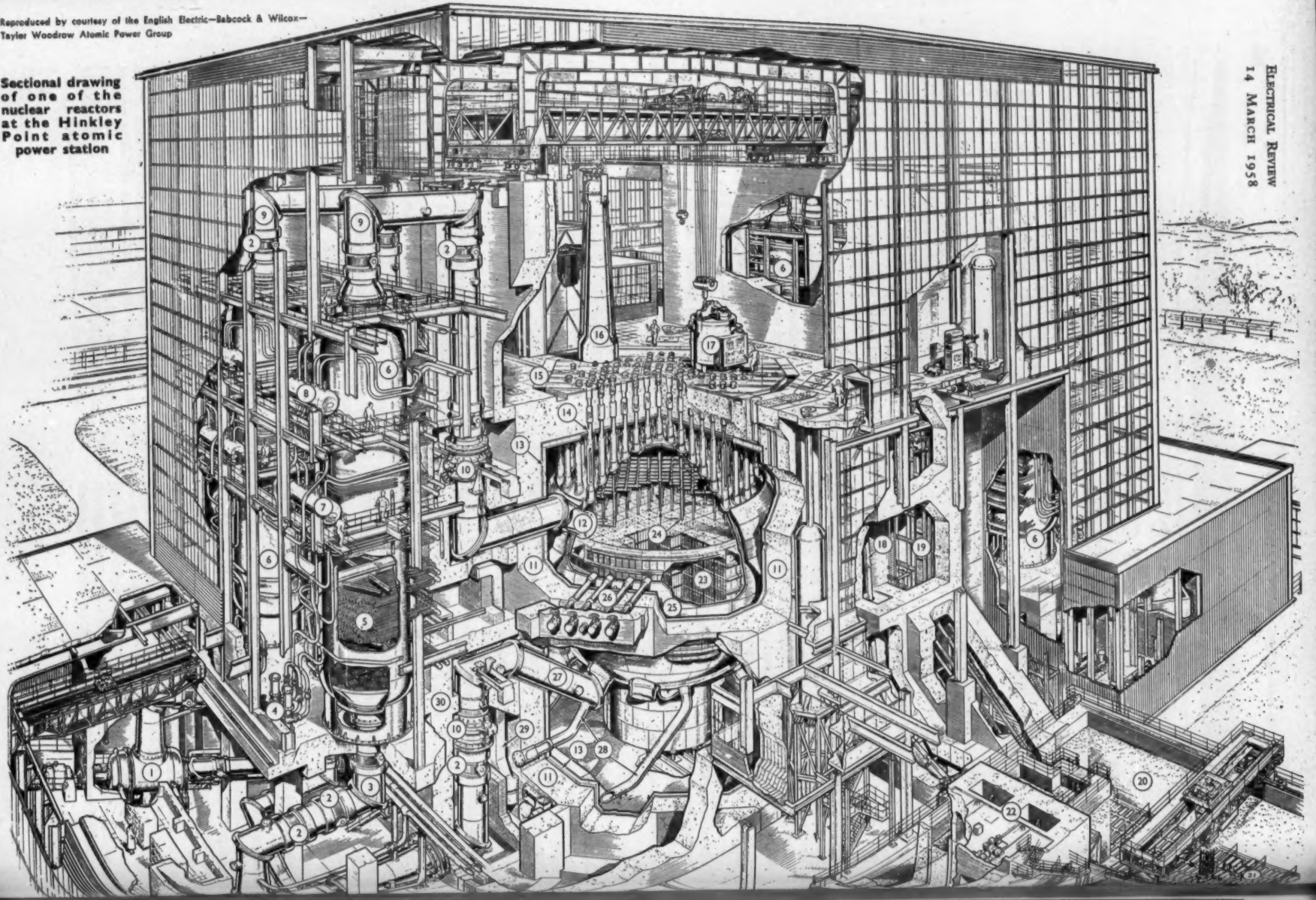
Sectional drawing of one of the nuclear reactors at the Hinkley Point atomic power station



REFERENCE KEY : 1. *Coolant-gas circulating blowers.* 2. *Hinged expansion bellows.* 3. *Coolant-gas outlet from steam-raising unit.* 4. *Steam-raising unit circulating pumps.* 5. *Stud-tube elements.*

REFERENCE KEY: 1. Coolant-gas circulating blowers. 2. Hinged expansion bellows. 3. Coolant-gas outlet from steam-raising unit. 4. Steam-raising unit circulating pumps. 5. Stud-tube elements. 6. Steam-raising units (six per reactor). 7. Low-pressure steam drum. 8. High-pressure steam drum. 9. Coolant-gas inlet to steam-raising unit. 10. Coolant-gas isolating valves. 11. Main biological shield. 12. Coolant-gas outlet from reactor. 13. Thermal shield. 14. Charge tubes. 15. Charge floor. 16. Hole-preparation machine. 17. Charge and discharge machine. 18. Emergency discharge chute. 19. Spent fuel-element skip hoist. 20. Cooling pond. 21. Storage skips and grid. 22. Skip loading bays. 23. Graphite-moderator core. 24. Control rod. 25. Reactor pressure vessel. 26. Can-failure detection standpipes. 27. Coolant-gas inlet to reactor. 28. Debris-removal ducts. 29. Shield cooling-air ducting. 30. Secondary biological shield

power stations increase this problem becomes more formidable and in order to keep site activity down to a very low level, considerable shielding becomes necessary in parts of the plant, and the site layout cannot always be as compact as would otherwise be desired.

The number of technical staff required for a nuclear power station is likely to be comparable with that in a conventional station. The number of operators is likely to be slightly less than in a conventional plant of similar capacity with similarly-sized turbines due to there only being two reactors.

Much of the mechanical maintenance in a conventional station is work on the coal and ash handling plants. This obviously has no comparable place in a nuclear power station, but there will be more work on intricate mechanisms, e.g. control rod mechanisms and charge and discharge equipment. For these and other reasons, the number of mechanical and electrical maintenance personnel is likely to be about the same as in conventional plant. Instrument maintenance will certainly be of more importance than in conventional stations and require more men. In addition, there will be a small number of health physics personnel.

Berkeley and Bradwell stations, with net outputs of 275 MW and 300 MW respectively, are likely to need a staff of about 300, whilst Hinkley Point will need very few more for a net output of 500 MW.

The foregoing article is not intended as a detailed account of all the operational considerations for nuclear power stations, but it is hoped that electrical engineers will have been given some idea of these aspects. Acknowledgment is due to Mr. F. H. S. Brown, chief engineer of the Central Electricity Generating Board, for permission to publish this article. The author also wishes to emphasise that the views expressed are his own and not necessarily those of the Board.

HINKLEY POINT

500 MW Nuclear Power Station

WE publish the accompanying sectional drawing of one of the two reactor buildings of the atomic power station at Hinkley Point, Somerset, which is now being constructed by the English Electric-Babcock & Wilcox-Taylor Woodrow Atomic Power Group for the Central Electricity Generating Board, because it illustrates in marked manner part of the description of the station which was published in the *Electrical Review* on 20th September, 1957. It will be recalled that the plans provide for two gas-cooled, graphite-moderated reactors, each contained in a 67ft diameter spherical pressure vessel of steel 3in thick. The weight of each reactor with its pressure vessel will be 5,500 tons. The reactors are designed for the use of natural uranium fuel contained in magnesium-alloy "cans." Refuelling will be effected from the top of the reactors while they are pressurised and on full power.

There are six boilers (steam raising units) per reactor. These are of the Babcock dual-pressure type, each being 90ft high, 21ft 6in in diameter, and weighing 1,350 tons. The total evaporation is 5·5 million lb of steam per hour. There are six gas circulators per reactor, and these are electrically driven and of the axial-flow type.

Electricity generation is by six 3,000 r.p.m. English Electric, hydrogen-cooled, three-cylinder turbo-alternators, each having an output of 93·5 MW, at 13·8 kV and 0·85 power factor. Auxiliary supply for the gas circulators, etc., is given by three 33 MW variable-speed turbo-alternators. The supply is taken via a switching and transformer station into the supergrid at 275 kV. The 35 million gallons of seawater per hour for condenser cooling is circulated by six centrifugal pumps.

The civil engineering work includes the construction of two 180ft high reactor buildings, a 740ft long turbine hall and other buildings, reactor biological shields of high-density concrete, 7ft thick, a 3,000ft long sea-wall, a circulating-water intake with 2,200ft long tunnels under the sea bed; and dock, wharf and approach roads. All this involves 750,000 cu yd of excavation and the placing of 300,000 cu yd of concrete.

Research Development Projects

THE eighth annual report of the National Research Development Corporation for the year ended 30th June, 1957 (H.M. Stationery Office, price 2s), reviews progress on various development projects initiated in previous years and describes for the first time some new projects.

The Corporation exists to sponsor the development or exploitation of inventions resulting from public research or any other invention which is not being sufficiently developed or exploited. During the first eight years of its existence it has sponsored one in twelve of the 6,000 inventions received.

Among development projects referred to in previous reports, further work on electronic digital computers has proceeded satisfactorily. A new project is under consideration concerned with research and development of very-high-speed computers. Work continues on Dr. Gabor's cathode-ray tube for colour television and it is hoped that the continuously-pumped experimental tube will be demonstrated at the meeting at the I.E.E. on 14th May. This development concerns a revolutionary system of electron optics which requires much less depth than that in the usual type of tube. It is hoped that a sealed-off version of the tube will have a depth of about 5in. This tube was described in an article in the *Wireless World* of December, 1956, entitled "Flat Tube for Colour T.V."

Siemens Brothers' Centenary

LAST WEEK'S CELEBRATIONS

IT was in 1858 that the business of Siemens Brothers began when Charles William (later Sir William) Siemens founded a London firm in association with Siemens & Halske, of Berlin, whose London agent Siemens had been. Consequently this is its hundredth year and the centenary was celebrated last week in a number of ways. The business is now part of the Associated Electrical Industries Group.

First there was the publication of a book by J. D. Scott, "Siemens Brothers 1858-1958" (Weidenfeld & Nicolson, London, 279 pp, 35s net) in which the beginnings of the concern are traced and its history pursued over the next century in a very readable and independent way. (The author is a former literary editor of the *Spectator*.) The book is in the following parts:—"The Founder and the Foundations"; "Finance and Organisation"; "Technical Development"; "Capacity and Production"; "War: The Mobilisation of Effort"; and "Labour Relations."

The author has done well to produce in comparatively small compass a conspectus of the varied activities of the concern during the last hundred years. The company was among the pioneers of practically every major electrical development in the early decades of the industry—cables, dynamos, lighting, telegraphs and telephones—in both technical and commercial senses.

The book has great interest for both technical and commercial readers. For the former the account of research and development brings together many aspects of this, the fundamental, side of the company's activities. Those whose tastes lie in the financial and commercial field will appreciate the details of the company's relations with its German progenitors, Siemens & Halske, which were broken by the first world war and finally severed by the second.

On Monday last week we were invited to join a small Press party to look over the Woolwich works, where the first building, completed in 1863, still stands as a small part of the whole establishment. On this building a plaque has been affixed commemorating its foundation by William Siemens. At the works we were shown the manufacture of many types of cable—h.v. and l.v. power (including oil-filled), submarine, telecommunications (including coaxial) and polythene-insulated and braided wires. Then we inspected the production and assembly of telecommunication equipment which is remarkable for its intricacy and precision, involving a high degree of skill on the part of the operatives. Work is proceeding on the development of the electronic exchange which will eventually be the method of operating the national telephone service.

Dr. J. N. Aldington, B.Sc., F.R.I.C., F.Inst.P., M.I.E.E., F.I.E.S., chairman and managing director of Siemens Brothers & Co., Ltd., and managing director of Siemens Edison Swan, Ltd.

Our party was received by Mr. G. W. Giffin, director of manufacture, who briefly outlined the history of Siemens Bros. He was accompanied by Mr. W. G. Patterson, commercial director, and other principal officials. At luncheon Dr. J. N. Aldington, managing director of Siemens Edison Swan, Ltd., introduced Mr. Scott's book and spoke of his company's organisation and purposes.

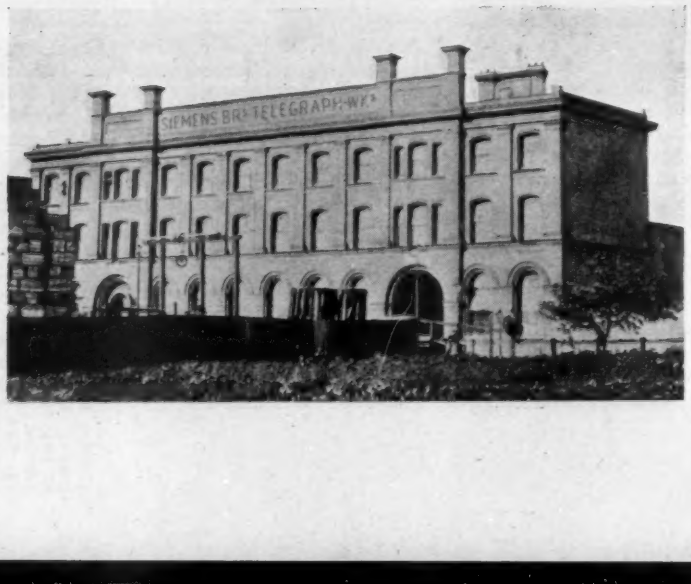
Centenary Lecture

The celebrations were formally inaugurated on the Wednesday evening when Dr. Aldington delivered a centenary lecture at the Central Hall, Westminster, before a large audience which included many people from other companies and organisations in the industry. Lord Chandos, chairman of Associated Electrical Industries, Ltd., presided and introduced the lecturer as a man who combined in a remarkable degree business and administrative ability with scientific attainment.

The lecture was a *tour de force*. Dr. Aldington spoke for an hour and three-quarters without wearying himself or his audience and illustrated his points with many lantern slides and dramatic demonstrations. While the lighting effects were probably the most spectacular, the most impressive feature was a conversation between Dr. Aldington and Mr. Peter Winstanley, of Siemens Brothers Canada, Ltd., in Winnipeg. This showed how clearly and directly speech was transmitted over the transatlantic telephone cable in the making and laying of which Siemens Bros., through Submarine Cables, Ltd., played a large part.

An adequate summary of what was itself a condensed history of the electrical industry over the last hundred years is clearly not feasible. We must be content to refer to the broad headings under which the lecture was arranged. Communications, the only aspect of electricity of much consequence a century ago, was the subject of the first part. After a brief survey of the work of Galvani, Volta, Humphrey Davy and Faraday, Dr. Aldington dealt with the activities of

The original works of Siemens Brothers at Woolwich



William Siemens from his advent to this country in 1843 as a young man of 20. Siemens displayed amazing versatility as well as pertinacity; he was interested in electroplating, a water meter, the regenerative steam engine and the Siemens-Martin steelmaking process, apart from the cables and dynamos which the firm was set up to produce. The developments in telegraphy and telephony in the course of the years, culminating in the transatlantic telephone cable and the electronic exchange, were noted and demonstrated by the lecturer.

Coming to "Power," Dr. Aldington displayed a simple application of Faraday's discovery and went on to deal with the machines which had arisen from that discovery, including the first self-excited dynamo produced by Siemens. This led up to a survey of arc lamps—the purpose for which the early dynamos were exclusively used. Such "by-products" as batteries and energy meters were referred to. From this the speaker turned to the achievements in the use of electricity for other purposes, including traction, and spoke of the evolution of power cables up to the very-high-voltage types in use to-day.

Lighting development was the subject of the next part of the lecture and the steps from the carbon arc to modern lamps of many types were ingeniously illustrated by examples and reproductions.

Finally Dr. Aldington took a brief look into the future and made reference to the possibilities lying in the use of semi-conductors and the electronic telephone exchange, and showed the "Centenary Neophone" telephone set (with printed circuits and unbreakable plastic body) which the company has developed for overseas markets, and he referred to improvements in cable making.

At the conclusion of the lecture Sir Gordon Radley, representing the Institution of Electrical Engineers and the G.P.O., thanked Dr. Aldington for his fascinating discourse and his excellent stage management. He also paid a tribute to the work of William Siemens and his company. In a brief reply Dr. Aldington disclaimed the credit for the demonstrations which, he said, was due to a number of his colleagues.

Celebration Dinner

Representatives of the company and its associates and guests from all branches of the electrical industry with leaders in other walks of life assembled for the centenary dinner at Grosvenor House, London, W.1, on the Thursday evening; about 1,200 people were present. Dr. Aldington presided and introduced Sir Alexander Fleck, chairman of Imperial Chemical Industries, Ltd., who proposed the toast of "Siemens Brothers & Co., Ltd." Dr. Aldington mentioned the presence of Mr. Sebastian de Ferranti, whose grandfather, Dr. S. Z. de Ferranti, had started his work in this country at the Siemens Woolwich factory.

Sir Alexander Fleck, in the course of his speech, referred to the friendship between Sir William Siemens and Lord Kelvin and recalled some amusing incidents in Siemens' life. He, Sir Alexander, said that he had one thing in common with Siemens—he was president of the British Association. He characterised Siemens as a great scientist, practical man and inventor. Sir Alexander concluded by wishing the company continued success.

Dr. Aldington, replying to the toast, said that Siemens was remarkable for his attention to detail—an attribute which still operated in his company. He said that he and his colleagues had had fears when it was known that they were becoming a part of the Associated Electrical Industries Group. These fears had been dissipated and the fusion of the Siemens and Edison Swan companies had resulted in a spirit of common purpose. The speaker thought that it would be unfortunate if the good relationships which existed within the electrical industry were upset.

The health of the guests was proposed by Viscount Chandos, chairman, Associated Electrical Industries, Ltd., in an amusing speech. Lord Chandos said that they were proud to have Siemens Brothers in the A.E.I. group. They had been looking back over the past century; perhaps Sir John Cockcroft who was replying to the toast would look forward over the next hundred years. Among the guests he welcomed representatives of the German Siemens concern. He also welcomed many of their competitors and customers; he hoped that they would all prosper, but he would like their customers to be even more prosperous then their competitors.

Sir John Cockcroft, director of the Atomic Energy Research Establishment, responded in felicitous terms, congratulating the company on its achievements and looking forward to even greater developments during the next century.

The proceedings concluded with a presentation by Lord Chandos to Mr. W. H. Grinsted, the former chief engineer of the company. In expressing his thanks, Mr. Grinsted mentioned that he had devoted fifty years to the development of telephony, forty-seven of them with Siemens Brothers & Co. In all that time he had not had one uninteresting day.

Charles William Siemens at the age of 55. (Reproduced from the Electrical Review of 1st February, 1878)

Science Museum Exhibition

A small exhibition presenting the life and work of Sir William Siemens was opened at the Science Museum on Monday last. It has been prepared in collaboration with Siemens Edison Swan, Ltd., and is based upon exhibits shown at the Central Hall on the occasion of the Centenary Lecture. The exhibition traces his career and achievements in a chronological sequence. The early years, up to his election to the Royal Society, are represented by exhibits relating to his inventions of that period, and to the beginnings of his work with submarine cables. His later work is represented by exhibits dealing with the practice of steel manufacture and with the development of the electrical industry.

HIGHWAY LIGHTING

A Comment on the Recent Conference on Highway Needs

By J. M. WALDRAM, B.Sc., F.I.E.S.*

A RECENT conference held at the Institution of Civil Engineers discussed the provision of highways in Britain to meet the present urgent needs of motor traffic and the foreseeable increases in it. The conference was directed to the layout, benefits and cost of highways rather than the details of construction, though some construction details were discussed, for example, the effects on the traffic of bends and junctions. It was doubtless rightly presumed that the first question was to decide what roads to build, and that the mere engineering of the road could safely be left to civil engineers as a routine matter.

Among the matters of detail which were scarcely mentioned was the question of lighting the highways and motorways. No doubt it was felt that with our present knowledge of street lighting, this presented few problems, if indeed it was intended to light the motorways at all.

It is true that we have much experience. Well before the war, we had over 3,000 miles of traffic routes lighted by discharge lamps. The report of the Departmental Committee of the Ministry of Transport constituted an informal Code of Good Practice which was realistic and farsighted. It has stood well for 20 years, and only now is in real need of revision. Since the war, according to Granville Berry, we have relighted about 5,000 miles of street.

These roads are, however, in built-up areas; our highways are rarely lighted. Indeed, by comparison with other countries we have few highways at all, and, when we get them, they will need something different from traffic route lighting. Our by-passes take the driver round agglomerations, but feed him into a system of ancient narrow roads on which he tries to travel fast by the light of headlights. When he comes with relief to a lighted section, too often it is to find that he is in a speed limit; for by a curious inversion of thought, road lighting has been used as an indication of a built-up area, so that where we are given the benefit of good visibility, we are unable to make good use of it.

If the expenditure on the new highways is to earn its return, they must be capable of use with the same speed and the same safety all round the clock. If it is pointless to provide five miles of costly double-carriageway which leads into a bottleneck, it is surely equally pointless to provide hundreds of miles of road graded and aligned for high speed and then fail to provide proper seeing conditions for half the hours of the day.

Growth of Traffic

The question of safety is uppermost, and is the sole reason for lighting highways. In deciding whether to light them or to rely upon headlights, we must consider not yesterday's traffic, but tomorrow's. A paper presented by Dr. Glanville and Dr. Smeed gives figures for the numbers of vehicles expected to be on the road, and concludes that in nine years' time, the number of vehicles in Britain will double, from seven million to 14 million. The congestion on our roads to-day is greater than in the United States, according to a paper by Nicholas. The average speed of private cars on good straight level roads in this country is 48 m.p.h., and that on Continental motorways 53 m.p.h. A comfortable gait on an autobahn is about 70 m.p.h., and powerful cars travel much faster. It is safe to assume that before any system of motorways can materialise in this country, we shall have twice our present traffic, with much of it capable of safely holding the road at 100 m.p.h.

At such speeds, a driver must have clear and unambiguous information about road conditions a long way ahead. At 30 m.p.h., he drives by conditions about 200ft to 300ft ahead. At 70 m.p.h., he is probably driving about half-a-mile ahead and his minimum stopping distance with properly adjusted brakes on a good dry surface is over 260ft. The coefficient of friction of tyre on the road diminishes with speed, and on a wet surface at 100 m.p.h. may be less than half its value at 30 m.p.h.

Visual Range with Headlights

Present-day driving headlight beams give a seeing distance without glare and in clear conditions, of the order of 375ft which is clearly inadequate for tomorrow's speeds and may not be really enough for to-day's. With glare, it becomes 150 to 200ft or less. The intensity of light needed to see at great distances, when objects have a small subtense, varies approximately as the fourth power of the distance. To see for 2,000ft, a conservative distance for really fast driving, the headlight intensity would have to be about 800 times the present maximum, or about 40 million candelas. With headlights, even if they could be provided, there would be no possibility of maintaining sufficient range under conditions of glare from opposing headlights, and they could only be used on roads where glare could not occur.

These estimates do not take into account effects of mist, which operates to diminish the visual range very sharply, which is more potent as the range is greater, and which cannot be compensated materially by further increase in intensity. The disconcerting and dangerous experience of meeting mist unexpectedly at night becomes worse as speed increases.

The above figures are very tentative and approximate, but they indicate that with the speeds and traffic density which are to be expected in the future, headlights cannot be expected to be adequate and safe. Drivers will not have to allow for slow or stopped vehicles, pedestrians or cyclists on the new motorways, but one has only to contemplate what would happen if, for example, a motorcycle were to skid and overturn, and be left unlit in the path of oncoming fast cars, to recognise the danger. In such traffic conditions any accident is likely to be severe and to involve several vehicles.

Street lighting is fundamentally different from lighting by headlights, in that the range of seeing is not limited. In a good system, one should see clearly where the road goes and what is on it, until the road bends or goes over a hill. It is much less affected by mist than headlighting, and gives due warning of the presence of mist. It indicates extraordinarily well the run of the road, and can be designed to be substantially without glare. The cost is not negligible, but it is small compared with the cost of constructing the road. Nicholas and Wilkes' paper to

* Research Laboratories, G.E.C.

the Institution gives the cost of motorways as about £350,000 per mile. The cost of lighting might be not much more than one-tenth of 1 per cent of the cost of construction. The resulting saving to be effected is difficult to compute, but can be gauged from the figures in Glanville and Smeed's paper of about 5s per vehicle-hour of time saved. If it is worth while to spend £350,000 per mile on building new roads, it is surely worth a few hundred more to make them safe and fast for half the hours of the day.

Street lighting systems for motorways call for special study, both technical and economic. Traffic route lighting is probably not the best solution. It is designed for urban conditions, and for traffic moving at 30 m.p.h. For motorways, it needs to be very efficient, because the cost of providing energy and light in open country is much higher than in cities. It also needs to be free from glare and from the repetitive effects which can be monotonous and soporific.

On the Continent the practice is to use higher mounting heights than usual to increase spacing. On the Brussels-Antwerp road the sodium lamps used in open country change to mercury fluorescent lamps at the villages, which provides a welcome change and keeps the driver informed of his whereabouts. Boereboom has advocated the provision of floodlighted features at intervals, for similar reasons, on roads which by-pass villages. One hopes that they will not be advertisements.

The lighting of direction signs needs parallel study, the more so since junctions may well be more complex, and the driver who over-runs his turning may have much difficulty in getting back to it.

Railway Electrification in Sweden

THE Sir Seymour Biscoe Tritton Lecture was given to the Institution of Locomotive Engineers in London on 26th February by Mr. Erik Upmark, C.E., Director-General of the Swedish State Railways, who took as his subject "The Development of Electric Traction in Sweden and its Influence on Rolling Stock." Mr. Upmark described the general background of railway electrification in Sweden. A small change in system was made some 35 years ago, when a supply at 15 c/s from a power plant was replaced by the present frequency of 16⅔ c/s from rotary convertor substations. It was now natural to carry on with the existing form of 16 kV single-phase electrification, taking advantage of the standardisation which had been built up over a long period. The advantages of the supply arrangements adopted were that the cheapness of the water power made losses in the motor-generators less severely felt, while the synchronous motors produced reactive current and thus had a stabilising effect on the operation of the extensive three-phase power lines. In Swedish conditions, the unbalance presented by an industrial frequency single-phase traction load would have greater disadvantages than in Great Britain or in parts of the Continent where the density of electric load was generally high. A change of system in Sweden was unlikely unless some remarkable new features entered the picture, such as in the field of germanium or silicon rectifiers.

A light overhead system was used, the normal pantograph pressure being only 11 lb, and the weight of the contact wire being also lower than on other systems, including those operating at 25 kV. The contact wire was of copper or cadmium copper, with a cross-sectional area of 0·125 or 0·155 sq in. Pantograph collector strips, once of aluminium, were now all of carbon, whereby the life of the copper wire had been greatly increased. The light and economical overhead construction had been useful in reducing capital costs when lines of low traffic density were electrified, but on lines where density had doubled and speeds were higher to-day compared with 20 or 30 years ago, when they were electrified, it was possible that a somewhat heavier construction might give less trouble and lower total costs.

Although there was some conversion between 1913 and 1929, most of the Swedish electrification was undertaken in the 1930's, encouraged partly by the low costs and ample industrial capacity. To-day 45 per cent of the 10,000 miles of railway lines were electrified and these dealt with 63 per cent of the trains, 85 per cent of the axle-miles and nearly 90 per cent of the gross ton-miles, excluding locomotives. Annual energy consumption figures showed that electric traction took 1,400 million kWh, steam traction 250,000 tons of coal, etc., and diesel traction 30,000 tons of diesel oil.

Swedish specialists considered that the problems of electric traction, if any, were not associated with the single-phase traction motor operating at 16⅔ c/s, at least if its size was not too much reduced. Machines now in use gave black commutation, ran a mileage of 400,000 without the necessity of turning down the commutators, and in one case weighed as little as 7 lb per horsepower. Many improvements in motor design, utilisation of materials and ventilation had been introduced over the years, largely on the initiative of the late Mr. G. Thielers of ASEA, a firm which had taken the lead in the supply of single-phase locomotives in conjunction with the mechanical engineering firms of Motala, NOHAB and ASJ, and of Mr. Robert Dahlander and Mr. Ivan Oeverholm of the State Railways.

Method of Drive

An important section of Mr. Upmark's paper dealt with mechanical questions and the effect of electric locomotives on the permanent way. He referred to the continuing use of coupling-rod drive in some locomotives and explained that a 2,500 h.p. locomotive of this type for a top speed of 60 m.p.h. could now be obtained in Sweden for £60,000, or about £24 per horsepower. The majority of trains in Sweden did not need to run faster than 60 m.p.h. or to climb gradients of more than 1 in 100. Relatively low capital cost, low maintenance costs, 6d per mile in all, and robust construction were all important arguments in favour of this type of locomotive. Individual axle drives had been used on locomotives since 1935 and there were now six main types in this category.

Of the electric trains run by the Swedish State Railways, locomotives represented 92 per cent, motor-coach trains 6 per cent and rail-buses only 2 per cent. Motor-coach trains averaging 60 m.p.h. and with a maximum speed of 85 m.p.h. were run between Stockholm and Malmo, and between Stockholm and Goteborg. Electric heating had been introduced on 95 per cent of the passenger stock, heating requirements being 35 kW per coach. All modern dining cars were equipped with complete air conditioning and fully-electric kitchens.

Electricity Supply Industry

STRUCTURE AND FUNCTIONS

MANY of our readers are not yet familiar with the new structure of the electricity supply industry and so for their guidance we have produced the accompanying chart showing the relationship of the Central Electricity Generating Board and the Area Boards to the Electricity Council.

It will be seen that the Council is composed of the chairmen of the twelve Area Boards; the chairman, deputy chairman and another member of the Generating Board; one full-time member (Mr. C. T. Melling) and a part-time member (Lord Citrine); with a chairman (Sir Henry Self) and two deputy chairmen, Sir Josiah Eccles and Professor R. S. Edwards, the latter being part-time.

The Generating Board's organisation consists of a chairman (Sir Christopher Hinton), a deputy chairman (Mr. C. R. King), four full-time and four part-time members; one full-time member, Mr. L. Rotherham, takes up his position on 1st April. Under the Board are five Regions, each with a director (Mr. A. R. Cooper is a regional director as well as a full-time member of the Board). There are also three Engineering Project Offices in charge of chief project engineers. The eleven operating divisions which existed under the former regime are retained. They remain under divisional controllers, but accountancy and some administrative functions will gradually be brought together at the regional offices.

This covers the generating and main transmission side of the industry. Secondary transmission and distribution follow the pre-existing arrangements. There are twelve Area Boards whose territories are generally divided into Sub-Areas which, in turn, embrace a number of Districts. This is the "three-tier" arrangement introduced at the time of nationalisation in 1948. Some Area Boards favour a change and in the case of the London Board the area has now been re-allocated entirely to enlarged Districts of which there are eighteen. The South Western Board is to institute a similar arrangement on 1st April.

The Regional arrangement of the Central Electricity Generating Board's organisation

Under the Electricity Act, 1957, the general functions of the Electricity Council are "(a) to advise the Minister [of Power] on questions affecting the electricity supply industry and questions relating thereto; and (b) to promote and assist the maintenance and development by Electricity Boards in England and Wales of an efficient, co-ordinated and economical system of electricity supply." With the authorisation of the Electricity Boards, or a group of them, the Council can "perform services for, or act on behalf of, the Boards concerned in relation to matters of common interest to those Boards."

The general powers of the Central Electricity Generating Board are "(a) to generate or acquire supplies of electricity; and to provide bulk supplies of electricity for the Area Boards for distribution by those Boards." It also has powers to manufacture anything which it or the Area Boards require for purposes of research or development or for the repair and maintenance of their equipment; to sell, hire or otherwise supply electrical plant; and to install, repair, maintain or remove any electrical plant or fittings.

The Council, the Generating Board and Area Boards have powers to raise capital by the issue of stock, subject to the Minister's approval and Treasury consent. Members of the Council, Generating Board and Area Boards are all appointed by the Minister of Power, as are the members of the Electricity Consultative Councils which represent the consumers' interests and advise the Area Boards.

The Generating and Area Boards are required to submit to the Council periodical estimates of the sums they require to be provided by the issue of British Electricity Stock. The Council must not proceed to exercise its powers of borrowing to defray expenditure incurred by a Board unless it is satisfied that the reorganisation and development involved conforms to a general programme settled by the Board and approved by the Minister.

Scottish Organisation

All the foregoing information applies only to England and Wales. In Scotland electricity supply is in the hands of the North of Scotland Hydro-Electric Board and the South of Scotland Electricity Board which operate under their own separate Acts of Parliament. Both Scottish Boards are responsible for generation as well as distribution. The North of Scotland Board consists of the chairman (the Rt. Hon. Thomas Johnston) with a deputy chairman (Sir Hugh Mackenzie) and seven members. Its territory is divided into fifteen Areas which are the ultimate units.

The South of Scotland Board operates through eight Areas, divided into 34 Districts. Mr. J. S. Pickles is the chairman of the Board, Mr. W. Hutton deputy chairman, and there are seven part-time members.

The Electricity Council

C.E.G.B. representatives:
- C. R. KING — Deputy Chairman
- SIR CHRISTOPHER HINTON — Chairman
- E. LONG

Full-time members:
- L. ROTHERHAM
- A. R. COOPER
- F. H. S. BROWN

Part-time members:
- SIR CHARLES GEDDES
- SIR WILLIAM HOLFORD
- G. A. S. NAIRN
- SIR LESLIE NICHOLLS

- LORD CITRINE (part-time)
- C. T. MELLING (full-time)
- Deputy Chairman (part-time) PROF. R. S. EDWARDS
- Chairman SIR HENRY SELF
- Deputy Chairman (full-time) SIR JOSIAH ECCLES

Central Electricity Generating Board

REGIONS AND REGIONAL DIRECTORS	DIVISIONS	CONTROLLERS
North Eastern & Yorkshire — P. BRIGGS	North Eastern	J. C. MITCHELL
	Yorkshire	C. G. RICHARDS
Midlands & East Midlands — R. L. BATLEY	Midlands	F. W. SKELCHER
	East Midlands	L. F. JEFFREY
Eastern, London & South Eastern — A. R. COOPER; Dep. Dir. H. J. BENNETT	Eastern	W. N. C. CLINCH
	London	H. J. BENNETT
	South Eastern	W. H. DUNKLEY
Southern, South Western & South Wales — A. C. THIRTLE	Southern	R. H. COATES
	South Western	A. R. CLAGUE
	South Wales	W. WILDE
N. West, Merseyside & N. Wales — W. C. PARKER; Dep. Dir. J. L. ASHWORTH	N. West, Merseyside & N. Wales	(To be appointed)

PROJECT OFFICES AND CHIEF PROJECT ENGINEERS

North	Midlands	London
C. W. A. PRIEST	R. R. MADDOCK	T. YULE

GENERATION AND MAIN TRANSMISSION

Area Board Chairmen:

DEPUTY CHAIRMEN	AREA BOARDS	SUB-AREAS	DISTRICTS
D. B. IRVING — A. N. TODD	London	0	18
N. ELLIOTT — W. R. T. SKINNER	South Eastern	5	28
R. R. B. BROWN — S. M. RIX	Southern	4	22
A. N. IRENS — E. C. WILLIS	South Western	4	23
H. V. PUGH — H. D. B. WOOD	Eastern	6	33
J. MOULD — N. F. MARSH	East Midlands	7	26
W. S. LEWIS — G. F. PEIRSON	Midlands	7	40
W. A. GALLON — H. PRYCE-JONES	South Wales	4	28
D. H. KENDON — J. RANKIN	Merseyside & North Wales	4	18
D. BELLAMY — A. BOND	Yorkshire	7	20
T. M. AYRES — G. N. GREEN	North Eastern	5	38
T. E. DANIEL — T. COATES	North Western	7	33

SECONDARY TRANSMISSION AND DISTRIBUTION

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VIEWS on the NEWS

By REFLECTOR

GOLDEN jubilees are becoming common in the electrical industry, for many companies were founded in the earlier years of this century when electrical development began in earnest. But centenaries are still rare and deserve more attention. Such is that of Siemens Brothers which was celebrated last week. Of course this business is not the first to record a hundred years; for instance, Henley's reached their century some years ago. Siemens Brothers may claim, however, that they were pioneers in a wider field, embracing cables, lamps, telecommunication equipment, batteries and meters—practically every branch in the early days. The celebrations have been on a grand scale. Now the business, combined with that of the Edison Swan Company, forms part of the A.E.I. Group, a relationship which, it is believed, will be of considerable advantage as the business enters upon its second century.

* * *

Last week the *Electrical Review* quoted Sir Harold Smith as saying that purchase tax as it stood to-day was far more suited to a Gilbert and Sullivan opera than to any business or commercial undertaking. On 6th March Mr. Justice Roxburgh, in the High Court, was asked to decide whether a certain hand-operated duplicator was a "machine" (free from purchase tax) or an "office requisite" (taxable). He decided that as it did something a human hand could not do it was a machine. *The Times* reports him as saying that

> "he did feel that those members of the Legislature who provided the Schedule to the Act [the Finance Act, 1948] and thus provided the Court with this particular problem must have been laughing up their sleeves."

But the laughter of the victims of these anomalies is of the bitter sort.

* * *

An article has been published by the *Macclesfield Times and Courier* on the all-electric home of Mr. Sebastian de Ferranti, which seems to be as good as anything the United States has to show. But I am a little puzzled by one paragraph in which it is said:—

> "Behind accessible cupboard doors is found a miniature power house where trip wires make broken fuses a thing of the past."

Trip wires are usually associated with broken limbs rather than "broken" fuses.

* * *

A special correspondent of the *Manchester Guardian* reports that the Cwm Rheidol Defence Association is at odds with the Central Electricity Authority (or, more properly, the Central Electricity Generating Board) over the fate of Trotter's Falls which will be replaced by hydro-electric works on the Rheidol River. Argument has centred upon the removal of a bridge and the building of a new one for the passage of materials for the dam and power station. The Association thinks that a new permanent bridge should be erected by the Board in another position. Fish, of course, also came into the arguments. There is salmon in the stream and the report says:—

> "According to the C.E.A. (advised by fishery authorities) few salmon at present succeed in navigating Trotter's Falls: according to residents of the valley their leaping of the falls, aided by rock ledges forming a natural fish ladder, is one of the local sights."

* * *

It has been said that a great part of the cost of the equipment of an all-electric house can be met in the saving in building costs—the possibility of doing away with fireplaces, chimneys and so forth. Apparently building societies are not always willing to advance money on houses built in this way. A Manchester building firm planned to erect 70 all-electric houses without coal-burning arrangements but, reports the *Daily Mail*, spent a year endeavouring to secure the approval of building societies. At last one of these societies has agreed to make advances on the chimneyless houses and, it is said, another society has come round to the builders' way of thinking. The head of the firm says:—

> "I feel elated, because I'm quite convinced that fireplaces and chimneys are a thing of the past. The new floor heating in houses which have been occupied since last year is proving efficient and economical."

* * *

Telephone subscribers have been very critical of the last increase in charges and many have asked to be disconnected. It seems that the telephone started off by being rather expensive here. Eighty years ago the *Electrical Review* (15th March, 1878) referred to this in the following terms:—

> "The telephone is both an eminently fortunate and unfortunate invention. It is fortunate in being a marvel, and well suited for popular use. It is unfortunate in being so exceedingly simple that it can be manufactured for a few shillings. This low cost of production militates against any high royalty which may be charged for it on the grounds that it is a great and novel convenience. The proprietors of the Bell telephone have chosen to ignore its intrinsic cheapness as an instrument, and to charge a very heavy royalty under the monopolies granted them in America and England. They have looked only to the supposed advantages of the instrument, and have set a value on its prestige. The licensed price of a set of telephones, which can be made with fair profit for ten or twelve shillings, is £25 and £35 sterling. This price includes, it is true, an electric bell alarm arrangement, but that does not cost many shillings more."

Instrument makers, it was said later, were circumventing this by providing "do it yourself" kits from which people could themselves build telephones.

PERSONAL AND SOCIAL

News of Men and Women of the Industry

In order to co-ordinate and control all test and inspection activities within the company, Marconi's Wireless Telegraph Co., Ltd., has grouped the sections engaged in these activities into a single department to be known as the Test Department. **Mr. H. J. H. Wassell,** O.B.E., B.Sc., formerly chief radar engineer, has been appointed

Mr. H. J. H. Wassell

Mr. J. K. Todd

manager of the new department, and **Mr. J. K. Todd,** M.A., A.M.I.E.E., has become chief radar engineer.

Mr. Wassell has been with Marconi's nearly thirty years, having joined the company in 1929, in the same year as he graduated from Birmingham University with a first-class honours degree. His work on transmitter development led to his appointment as chief of the transmitter development group in 1945, and in 1949 he became head of the radar development group. He has held the position of chief radar engineer since 1955. Mr. Wassell was made an O.B.E. in 1953 for his work in connection with the radar defences of Great Britain.

Mr. Todd joined the company in 1937 after graduating from Cambridge University. In 1940 he entered the R.N.V.R. and attained the rank of lieut.-commander before leaving the service. He has been chief of the missile radar research group at the Marconi research laboratories since 1956.

Mr. J. Strattan, A.A.C.C.A., has been appointed accountant of the Ayrshire Area, at Kilmarnock, of the South of Scotland Electricity Board in succession to **Mr. A. C. Carse,** who, as we have reported, was recently appointed accountant of the Lanarkshire Area. Mr. Strattan has been an assistant financial officer at the Board's head office in Glasgow and was from 1950 until 1956 assistant accountant of the Ayrshire Area.

Mr. J. H. Gibson, A.M.I.E.E., has resigned his appointment as technical buyer with Switchgear & Cowans, Ltd., Manchester, to take up the position of contracts manager with Chamberlain & Hookham, Ltd., Birmingham. Mr. Gibson was educated at Rutherford Technical College, Newcastle-on-Tyne, and received his training with A. Reyrolle & Co., Ltd., with whom he was contracts and sales engineer from 1929 to 1932. From 1934 to 1935 he was an engineer in the Switchgear Section of B.E.A.M.A., and then was with the English Electric Co., Ltd., for a year as sales engineer. He joined Switchgear & Cowans, Ltd., in 1936 as sales and contracts engineer, becoming sales manager in 1950 and technical buyer in 1956.

Mr. L. A. Woodhead, director and general manager of Cossor Instruments, Ltd., has been appointed to lead a team sponsored by the Scientific Instrument Manufacturers' Association of Great Britain which will visit Canada in mid-March. The team, consisting of senior executives of seven S.I.M.A. member firms, will see the major industrial and scientific organisations in Toronto, Ottawa and Montreal.

Mr. D. G. E. Barrie, chairman and managing director of Metway Electrical Industries, Ltd., Brighton, tells us that he has just completed fifty years in the electrical industry. He started in 1908 with a firm of electrical manufacturers' agents and formed his present company in 1937.

Mr. C. R. Fielding has been appointed to the staff of Webb's Crystal Glass Co., Ltd., as assistant to the sales directors. He was previously with the A.E.I. Lamp & Lighting Co.

As was reported in our issue of 31st January last, **Mr. A. J. Beanland,** B.Sc. Tech., M.I.E.E., A.M.I. Prod.E., Fellow A.M.E.M.E., has been appointed group sales director of the Lancashire Dynamo Group, and on his leaving the Trafford Park Works of Lancashire Dynamo & Crypto, Ltd., on 27th February, presentations were made to him by Mr. J. Potts, on behalf of the office staff, by Mr. A. W. A. Dick-Cleland (joint managing director, L.D.C.), on behalf of the senior and management staff, and by Mr. J. Colley, chairman of the Social and Athletic Club.

Presentations to Mr. A. J. Beanland. Left to right: Mr. J. Potts, Mr. Beanland, Mr. A. W. A. Dick-Cleland and Mr. J. Colley

Mr. H. P. Lord, A.F.C., B.Sc.(Eng.), A.M.C.T., has been appointed general sales manager of Sigmund Pumps, Ltd.

Mr. A. McLellan, C.A., deputy accountant of the North West, Merseyside and North Wales Division of the Central Electricity Generating Board, has been appointed divisional accountant in the North West, Merseyside and North Wales Region of the Board.

Mr. McLellan was indentured to a firm of chartered accountants in Scotland. In 1932 he joined the Central Electricity Board as an accountant and in 1938 was appointed chief assistant to the district accountant for North West England and North Wales. In 1948 he became senior assistant accountant to the North Western Division of the C.E.A., becoming divisional accountant in 1949 and deputy accountant of the merged Merseyside and North Wales and North Western Divisions in 1954.

Mr. A. McLellan

The Merseyside and North Wales Electricity Board has announced the appointment of **Mr. P. B. Henderson,** M.A., B.Com., D.P.A., F.C.C.S., A.M.B.I.M., as secretary of No. 2 Sub-Area with headquarters near Northwich. Mr. Henderson, who has

seen service with the former North Eastern Electric Supply Co., Ltd., and the North Eastern Division of the Central Electricity Authority, is a graduate of the Administrative Staff College, Henley-on-Thames, and has spent some time in Italy examining administrative and organisation and methods techniques in the electricity supply industry in that country. During the war he served as a flight lieutenant in the R.A.F.V.R.

Mr. P. B. Henderson

Mr. G. B. Proctor, managing director of Transformers (Watford), Ltd., has recently returned to this country from a tour of East Africa and Southern Rhodesia. During his visit to Salisbury, Southern Rhodesia, the final stage of No. 3 power station, for which his company supplied the station and unit auxiliary transformers, was put on full load.

Among the appointments announced by Smiths Clocks & Watches, Ltd., is that of **Mr. R. Smith,** F.B.H.I., sales director, who has also been appointed divisional general manager.

Mr. P. Briggs, in his capacity as chairman of the Yorkshire District Joint Advisory Council of the Electricity Supply Industry, recently presented awards at this year's final of the Yorkshire Regional First Aid Competition held in Leeds on 8th March.

"The Electricity Board is the greatest boon electrical contractors have ever had; I really mean that," said Mr. J. A. Duncan, part-time member of Merseyside & North Wales Electricity Board, at the annual dinner of Liverpool branch of the **Electrical Contractors Association,** on 3rd March. In proposing the toast to the E.C.A., Mr. Duncan said he noted that electrical contractors estimated they did 85 to 90 per cent of the available contracting work. On vesting day there were 630,207 consumers in that area; to-day there were 885,233 and it might be assumed that contractors made 90 per cent of the connections. The Electricity Board believed in the policy of live and let live. The Board's three main lines of business were meeting the intense national demand for new housing, reinforcement, and rural electrification.

Electrical contractors were a fairly large body of men controlling small and moderate size businesses and they played an important part in the nation's affairs. He commended the aims of E.C.A. in promoting technical knowledge and the excellence of installation work.

Mr. H. S. Wathes (president E.C.A.), who replied, asked what the E.C.A. intended to do as it continued to grow up? That, he said, would depend to a great extent on what its members required of it, and the extent to which they were prepared to give their support.

They were fortunate to be in an industry in which opportunities were boundless. The fact that the Liverpool branch had provided two presidents was the outward sign of the tradition of service of the branch. The tradition of service expressed itself in a true realisation of responsibilities to the industry, the customers, the suppliers and the employees.

At the E.C.A. Liverpool Branch dinner: Left to right: Mr. A. V. Milton, Ald. F. H. Cain, Mr. H. S. Wathes (president) and Mr. C. C. Smith (Liverpool lighting engineer)

Mr. W. T. Trace proposed the toast to the guests. Referring to the E.T.U. attitude to the apprenticeship scheme, Mr. Trace said the E.C.A. was as keen as ever it had been upon the education and efficient training of the boys employed by members.

The Lord Mayor of Liverpool (Ald. F. H. Cain) remarked that Mr. Duncan was trailing his coat when he talked about rural electrification. When Liverpool had its own electricity undertaking it benefited to the extent of at least a 4d rate. Under nationalisation that benefit went towards the cost of financing rural electrification in North Wales. Mr. J. A. Pinnington presided at the dinner.

Mr. Hector McNeil, B.E., M.I.Mech.E., M.I.E.E., F.Inst.F., has been appointed managing director of Babcock & Wilcox, Ltd., in succession to **Sir Kenneth Hague,** M.I.Mech.E., M.I.E.E., who has expressed the wish to relinquish that position, which he has held since January, 1945. Sir Kenneth will continue to devote his services fully to the company in his position as deputy chairman. **Mr. J. S. Robertson,** general manager, has been appointed a director of the company to fill the vacancy created by the retirement from the board, at his own request, of **Mr. C. H. Sparks,** who has been a director for the past 18 years. Mr. Sparks will continue in his present capacity as engineering consultant to the company.

The annual dinner and reunion of the **Ex-Johnson & Phillips Association** was held at Grosvenor House, London, on 1st March, 100 members being present. Messrs. W. Grant, R. W. C. Reeves, G. T. W. Whitehead, J. B. McRostie, A. C. Hartley and G. Ainsworth Wates attended from the board of directors of Johnson & Phillips, Ltd. Mr. R. T. Lythall, of the Belmos Co., Ltd., and Everett, Edgcumbe & Co., Ltd., proposed the toast of the Association and Mr. A. J. Shrosbery, of T. Clarke & Co., Ltd., the chairman of the committee, replied, saying that the membership had now increased to 207. During the evening Mr. J. J. Smith, of the Electric Construction Co., Ltd., presented a number of technical books chosen by J. S. Leonard and D. E. Williams, who were invited to the dinner as being the two outstanding student apprentices at Charlton during the 1956-57 academical session.

Mr. L. D. Harkess, C.B.E., the director of contracts, Post Office Contracts Department, is retiring on 30th April next. He will be succeeded by **Mr. C. T. Meredith,** who is now the deputy director. **Mr. P. J. Mapplebeck,** F.C.A., F.S.C.C., an assistant director, will become the new deputy director.

Mr. J. G. Belsey, O.B.E., M.A., A.M.I.Mech.E., has been appointed to the board of Axia Fans, Ltd., a subsidiary of Vent-Axia, Ltd.

Mr. K. R. Brooker, A.M.I.E.E., has joined the staff of the Metropolitan Electric Cable & Construction Co., Ltd., as technical assistant to the general manager.

Mr. K. R. Brooker

Mr. Brooker was trained at Erith Technical College and Woolwich Polytechnic, and had factory experience at the Erith Works of the former Callender Co. and later British Insulated Callender's Cables, Ltd. He held various positions both in the technical and production organisations of those companies, specialising in his early days in dry core telephone cable, and later in all types of power cables. For ten years he was cable designs and specifications engineer at the Erith factory, which he also represented on several C.M.A. technical committees.

In 1950 Mr. Brooker joined Aberdare Cables, Ltd., as chief development and process engineer to establish the manufacture of super-voltage

cables and other projects. He returned to B.I.C.C. in the following year at Belvedere as manager of the Power Cables Department, and for the past two years has been special duties engineer to the production manager.

On the occasion of his recent retirement from the Electrical Research Association, **Dr. H. R. J. Klewe**

Dr. H. R. J. Klewe (left) receiving a presentation from Dr. H. G. Taylor

received a presentation from the director, Dr. H. G. Taylor, on behalf of his colleagues. Dr. Klewe was associated with E.R.A. work on telephone interference from the early days of the Shap tests in 1932 when he was on the staff of the *Reichpost*, and he has just completed a book, "Interference between Power Systems and Telecommunication Lines," which will be published shortly. He had been with the E.R.A. for eleven years, having joined the Association soon after the war under the Darwin scheme. He is now working for British Railways.

The Minister of Power has appointed **Ald. G. C. A. Mann**, J.P., of Ewell, Surrey, to be deputy chairman of the South Eastern Electricity Consultative Council with effect from 1st April next, in succession to **Brigadier F. T. Chapman**, C.B.E., D.Sc.(Eng.), A.M.I.C.E., Comp.I.Mech.E., M.I.E.E., of Bexleyheath, Kent, who is retiring on completion of his term of office on 31st March after nearly ten years of service with the Council.

In the photographs published with the report of the **I.E.E. North Staffordshire Sub-Centre's** annual dinner in our issue of 28th February, the photograph on the left shows Mr. T. E. Goldup (President) greeting Mr. J. M. Ferguson, not Mr. L. Goodall, as stated.

At Norwich last week over 300 persons attended the annual ladies' night of the **Norfolk Electrical Circle**, which this year celebrates its "coming-of-age." Mr. T. L. Wilkes, chairman, presided. Proposing the toast of the electrical industry, the Lord Mayor of Norwich, Councillor T. C. Eaton, said that the industry offered the greatest opportunities and rewards to those engaged in it, and on it depended the future prosperity of the country. Mr. H. V. Pugh, chairman of the Eastern Electricity Board, referring to the recent heavy snowfalls, praised the unstinted service rendered by the electricity supply engineers under difficult conditions and added that electricity was accepted without appreciating how much trouble went into making it available. The president, Mr. J. A. Sumner, proposed the toast of the ladies, to which Mrs. Wilkes replied.

Among the welfare funds for employees operated by **Enfield Cables, Ltd.**, is a sick visiting fund from which additional assistance is given to members who are away sick for long periods. Charitable grants are also made from this fund from time to time and on Tuesday last a television set, bought by the fund, was presented to Chase Farm Hospital, Enfield. The presentation was made by Miss I. E. McLintic, a member of the Welfare Committee.

Mr. G. H. Atkinson, one of the founders of T. Beadle & Co., Ltd., Hull, has decided to withdraw from active business affairs and has accordingly resigned from the company. During his long experience Mr. Atkinson has been associated with the Electrical Wholesalers' and the Radio Wholesalers' Federations.

Mr. G. Rutherford succeeds Mr. Atkinson as chairman and managing director, and **Mr. G. A. Mason** and **Mr. M. Pack** have been elected directors.

These changes are additional to the recent appointment as executive directors of **Mr. N. Larder** and **Mr. V. R. Gunthorpe.**

How good street lighting assists the work of the police in the prevention and detection of crime was the main theme of the address by the chief constable of Liverpool, Sir Charles Martin, at the annual luncheon of the Liverpool Centre of the **Illuminating Engineering Society** on 3rd March. He said he was deeply appreciative of the efforts of Mr. C. C. Smith, the city lighting engineer, in helping the police by improving the lighting of Liverpool's 1,000 miles of streets, entries and alleys.

Mr. E. B. Sawyer (president) said Liverpool had shown appreciation of the need for better lit streets by expediting its rate of progress, which was the result of the programme of lighting improvements. This had been planned by Mr. C. C. Smith, who was proposed as the next president of the I.E.S. and was a delegate to the Commission on International Illumination. Better lit streets would speed the movement of traffic and conduce to greater road safety.

The Lord Mayor of Liverpool, Ald. F. H. Cain, said the city was anxious to improve the standard of street lighting, but unfortunately financial restrictions imposed limitations.

Mr. W. B. Parkinson (Merseyside and North Wales Electricity Board), who presided, welcomed as guests Mr. D. H. Kendon (chairman) and other members and officers of the Board, Prof. J. M. Meek (Department of Electrical Engineering, University of Liverpool) and representatives of the I.E.E., E.C.A. and the Manchester Branch, I.E.S.

Mr. A. F. Plummer, president, was in the chair at last Tuesday's luncheon meeting of the **Electrical Industries Club**, at which the guest speaker was Mr. Brian Johnston, the well-known B.B.C. commentator and broadcaster. Mr. Johnston was in excellent form and his entertaining and witty discourse was much appreciated. After the vote of thanks, proposed by Mr. C. W. Cawte, the president reminded members that the next luncheon would take place on Tuesday, 15th April, and that this would be preceded by the annual general meeting. The luncheon speaker on this occasion will be Sir Christopher Hinton, chairman, Central Electricity Generating Board.

At the Cripplegate Theatre, London, E.C., last week the **G.E.C. Dramatic Society** presented "Haul for the

At the Liverpool luncheon of the Illuminating Engineering Society. Left to right: Mr. N. Blackman (hon. sec., Liverpool Centre), Mr. C. C. Smith (Liverpool lighting engineer), Mr. W. B. Parkinson, chairman, Liverpool Centre) and Mr. W. Gilchrist (chief commercial officer, Merseyside and North Wales Electricity Board)

Shore," a comedy by Jean McConnell and, as usual, acquitted themselves very well. The play shows how the newly-arrived vicar of a Cornish village is gradually persuaded, against all his principles, to take a hand in the village's staple "industry," the extraction of the contents of ships wrecked on the local rocks. The evenly balanced dialogue of the play gives all the actors a fair chance of showing their merits and sharing the credit. The cast consisted of Mary Andrew, Frederick Coker, Paul Sproxton, Joan Morrison, Michael Hobbins, Norman Waight, Ray Pepper, Shirley Linge, Valerie Simmonds and Michael Osborne and the play was produced by Florence Scantlebury. A donation from the proceeds is being given to the E.I.B.A.

OBITUARY

Mr. Philip Franklin Lloyd, who until he relinquished the position in 1944 due to ill-health, was head of the Export Sales Department in London of the British Thomson-Houston Co., Ltd., died on 3rd March last at the age of seventy-four.

The late Mr. P. F. Lloyd

A native of Bristol, Mr. Lloyd was educated at Wycliffe College and the Merchant Venturers' Technical College (now Bristol University). He joined the B.T.H., Rugby, on a special course in 1904 and was transferred to the Export Department, Rugby (then the Foreign Department) in 1907, remaining there until 1911, when he went to the London office of the General Electric Co. of New York. From 1911 to 1917, Mr. Lloyd was B.T.H. representative at the International General Electric Co.'s office in Japan. Returning to England he joined the Inns of Court Officers' Training Corps and after obtaining a commission in the Royal Engineers (Signals) served in France until the end of the 1914-18 war. Mr. Lloyd re-joined the B.T.H. Co., in 1919, working in the Export Department at Rugby until 1922 when he transferred to the Export Sales Department, London. Appointed manager in 1934, he relinquished the position in 1944 due to ill-health and went to live at Marhamchurch, Bude, Cornwall. He was a member of the B.T.H. Overseas Association and had held the office of vice-chairman.

Mr. Patrick James Reilly, supervisor of the outside erection staff (London area) of Ferguson Pailin, Ltd., died recently. Mr. Reilly had been in the company's employ for thirty-seven years, for more than thirty of which he had been attached to the London office, engaged in the erection of switchgear in the Southern area.

Electricity–Gas Co-operation

THE promised Government statement on the appointment of a Committee to investigate means of improved co-operation between the Gas and Electricity Boards, and associated matters, was given in the House of Commons on Monday in answer to a question by Mr. G. Nabarro.

Sir Ian Horobin, Parliamentary Secretary, Ministry of Power, said the terms of reference of the Committee were: "To consider ways in which, by co-operation between the Area and Scottish Electricity and Gas Boards in the performance of their respective statutory functions, the administration of the services of a like kind provided to the public by the two industries might be improved; and to make recommendations."

He said the Committee would consist of Sir Cecil Weir, the chairman; Mr. R. R. B. Brown (Southern Electricity Board); Mr. G. le B. Diamond (West Midlands Gas Board); Sir Edward Herbert (East Midlands Gas Board); Sir John Imrie (South of Scotland Electricity Board); Sir Henry Jones (Gas Council); Mr. C. T. Melling (Electricity Council); and Mr. Austin Morley (W. & T. Avery, Ltd.). Another appointment was being made and would be announced in due course.

The Secretary to the Committee would be Mr. W. R. G. Bell, of the Ministry of Power, Thames House South, Millbank, London, S.W.1.

The terms of reference of the Committee, according to a Ministry spokesman, are intended to make it clear that the Committee is not concerned with the general policy of the electricity and gas industries or with competition between them. In recent debates in both Houses it has, in fact, been stated that the Government are in favour of competition between the two. But there are several respects, the Ministry point out, in which it has been suggested that each of the two industries spends money in the same area on services connected with the distribution of its products, such as on showrooms or meter readings, where without affecting the basic and healthy competition between the two it might be possible for Area Gas and Electricity Boards—and in Scotland, of course, the Scottish Electricity Boards—to co-operate.

Action Against Refrigerator Suppliers

IN the High Court last week Mrs. Elspeth Nicol Reed, a former Mayoress of Finchley, told Mr. Justice McNair that when she put one hand on the handle of a refrigerator and the other on a radiator at her home she had a shock which travelled up "my right arm, along my chest and down my left arm." "It seemed a terribly long time" before she was freed.

She and her husband sued Harrods, Ltd., who supplied the refrigerator in December, 1953, and admitted liability. The accident occurred in October, 1954. Mrs. Reed claimed damages for injury which she suffered as the result of the shock and her husband claimed expenses incurred through the accident.

The consequence of the shock was that Mrs. Reed's right arm went into "a sort of spasm." It was some time before it could be removed from the refrigerator and she suffered considerable pain and injuries to her arm, shoulder and the back of the neck. An engineer from Harrods was there at the time and he threw himself on her left arm and freed it from the radiator. Mrs. Reed said that her arm was sore and stiff afterwards. She could now only do light housework and had difficulty in dressing. She found that if her right arm was still for long she had to pick it up with her left hand before she could move it.

Awarding Mrs. Reed £750 and her husband £807 9s, Mr. Justice McNair said she had lost some sensitivity in the thumb, middle, and ring fingers of her right hand, and even now needed some sedative to secure sleep. But she had been able to drive her car since Christmas, 1954, and her injuries had not prevented her from going on a visit to the United States or taking up her duties as the Mayoress of Finchley. The Judge ordered that Mr. and Mrs. Reed should have costs up to the payment into court by the defendants of £751 on the wife's claim and £835 on her husband's and the defendants would have costs afterwards.

Factory Thermal Insulation

Proposals for regulations to be made under the Thermal Insulation (Industrial Buildings) Act, 1957, are contained in a memorandum which has been circulated by the Ministry of Power to organisations interested for their comments.

The main purpose of the Act, which became law last July, is to prevent the unnecessary waste of fuel that occurs as a result of inadequately insulated buildings. The Act applies only to new factories started on or after 1st January, 1959. It does not lay down any standard of insulation but empowers the Minister to make regulations prescribing a standard and dealing with other related matters.

INDUSTRIAL NEWS

Atomic Reactor Insurance

Representatives of insurance companies from fifteen European countries meeting in London last week reached agreement upon the principles which should govern insurance against risks from nuclear reactors. During the proceedings it was mentioned that the British insurance pool had received inquiries relating to eighteen reactors and premiums (undisclosed) had been agreed in the cases of nine of them. Among the points of agreement reached was that those responsible for reactors should effectively cover their third party risks. It was stated that the material risks of the Calder Hall type of reactor had been put at £30 million. A special committee is to meet in Paris in April to deal with some of the more detailed arrangements proposed.

British Overseas Fairs, Ltd.

The Federation of British Industries announces that Mr. Leslie Gamage, chairman and managing director of the General Electric Co., Ltd., has decided to resign from the chairmanship of British Overseas Fairs, Ltd., because of the pressure of increased responsibilities. He will remain a member of the board. Sir Norman Kipping, director-general of the F.B.I., has been elected chairman in succession to Mr. Gamage, and Mr. W. P. O. Edwards has been appointed managing director. The other members of the board are Lord Dudley and Mr. P. F. D. Tennant.

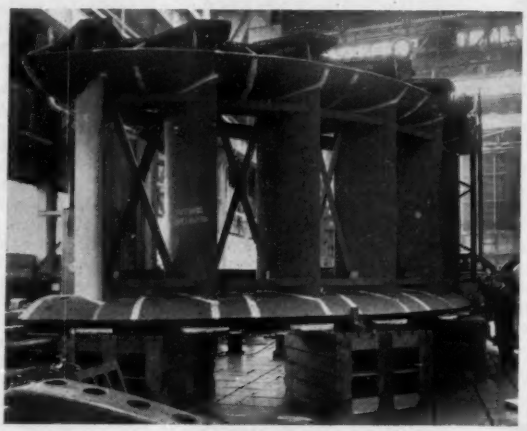
British Overseas Fairs, Ltd., is a wholly-owned subsidiary company of the F.B.I. and was established to organise all-British trade fairs overseas. It was responsible for the British Trade Fairs at Baghdad in 1954, Copenhagen in 1955 and Helsinki in 1957. It is at present organising the British Industries Pavilion at the Brussels Exhibition.

Large American Orders

The English Electric Export & Trading Co., Ltd., has obtained a further contract, valued at some $5½ million, for Priest Rapids in the State of Washington, United States. The company is to supply two more water turbine generating sets, each of 83,000 kVA at 85·7 r.p.m. The English Electric Co. is already supplying the first eight turbines and generators and five transformers for Priest Rapids, in conjunction with Merritt-Chapman & Scott, who are undertaking the civil work as main contractors.

The Priest Rapids project is one of a chain of stations being built to develop water power along the Columbia River system in the Pacific North-West. Its site is downstream from Grand Coulee, Chief Joseph and Rock Island Dams, but upstream of McNary Dam and immediately above the confluence of Snake River with Columbia River. The new dam and power house are an undertaking of Grant County Public Utility District No. 2 of Ephrata, Washington State.

Besides the ten 114,000 h.p. water turbines and 83,000 kVA generators, the English Electric Co. is also supplying five transformers of 183,000 kVA to raise the generating voltage of 13·2 to 230 kV for transmission to various consuming centres. The project is under the technical supervision of the Harza Engineering Co., of Chicago, Ill., whose services have been retained by Grant County P.U.D. as consultants.



The first stay-ring quadrant of an 83,000 kVA English Electric water turbine set for Priest Rapids, U.S.A., being face finished

The United States Army Corps of Engineers has placed a further order for Table Rock power station, White River, Missouri, with the English Electric Export & Trading Co., Ltd. The contract, valued at some $220,000, is to manufacture and deliver a second generator transformer for the station, which is a duplicate of the one ordered from the company in November, 1955. It is a 90,750/121,000 kVA, 13·2/161 kV, three-phase, 60 c/s power transformer, with accessories and spare parts.

B.I.F. Electrical Exhibitors' Committee

The affairs of the B.I.F. Electrical Exhibitors' Committee, which it was decided to wind up a short time ago, have now been finally settled and by agreement of the Committee and the electrical exhibitors (who contributed towards the running expenses) a cheque for the remaining balance in hand, i.e. £34 15s 9d, has been sent to the Electrical Industries Benevolent Association.

Computer for South Africa

An electronic digital computer has been ordered from Standard Telephones & Cables, Ltd., by the National Physical Research Laboratory of the Council for Scientific and Industrial Research of South Africa.

The machine is called "Stantec Zebra" and will be used to carry out calculations for pure and applied research problems by the N.P.R.L.'s Applied Mathematics Section. Work in a variety of fields will be undertaken including nuclear physics, crystallography dynamics, telecommunication and statistical problems. It will also be made available to industrial organisations in the Union of South Africa.

Enfield Cables in Canada

Enfield Cables, Ltd., announces the signing of an agreement with the Federal Wire and Cable Division, H. K. Porter Co. (Canada), Ltd., whereby that organisation will market Enfield products in Canada. The agreement also provides for the sharing of technical knowledge and experience should Federal Wires & Cables decide to embark on the manufacture of power cables in the future. Enfield Cables' resident engineer in Canada, Mr. J. Morgan-Blades, will remain in his present position and will act as technical adviser on the Federal Wire and Cable Division on power cable matters.

Electrical Equipment for Iran

The Metropolitan-Vickers Electrical Co., Ltd., has been awarded a contract valued at approximately £1½ million, covering the construction and equipping of the Gach Saran power station for the Iranian Oil Exploration & Producing Co. The scheme will comprise a 12 MW power station, switchgear, transformers and transmission lines in the Gach Saran oilfield situated some 2,500ft above sea level in Southern Iran, whence oil will be piped to a new sea terminal at Kharg Island in the Persian Gulf. Sub-contractors for the associated civil engineering are Richard Costain, Ltd., and for the transmission lines and cable work the British Insulated Callender's Construction Co., Ltd.

The consulting engineers are Ewbank & Partners, Ltd. The complete system is to be commissioned in May, 1960.

The generating plant will consist of three L.51.C gas turbine-generators nominally rated at 4,000 kW: the maximum rating of each unit will be 5,500 kW. They will supply a.c. at 11 kV 50 c/s, which will be stepped up to 33 kV for main transmission. Distribution and utilisation will be at 11 kV, 3·3 kV and 440 V.

Turbo-Alternator Sets for the C.E.G.B.

Richardsons Westgarth (Hartlepool), Ltd., has received notification from the Central Electricity Generating Board that an order is to be placed with the company for the construction, erection and commissioning of two 120 MW reheat steam turbo-alternator sets; the value of the order is more than £1¾ million.

The company has recently completed the construction of a gas turbo-alternator for Shelton Iron & Steel, Ltd., and demonstrations of this were held recently in its works at Hartlepool. This turbine, which will operate on either blast furnace gas and/or oil fuel, is the first of its kind to be built in this country for installation in a steel works.

Power and Energy at Brussels

General satisfaction with the progress being made in the erection of the stands in the power and energy section of the British Industrial Pavilion at the Brussels Exhibition was expressed at a press conference held last week in the London headquarters of the Federation of British Industries. The organisers were also confident that the exhibits would be successful and entirely worthy of a branch of industry that last year exported nearly £280 million worth of equipment.

The largest of the five stands or areas in this section of the Pavilion will be the co-operative exhibit entitled "Power for Progress" which is supported by seven trade associations and 158 firms in the electrical and allied industries. A general description of this exhibit was given in our issue of 7th February. The stand being organised by the Board of Trade and the Atomic Energy Authority will not only document Britain's achievement in producing the world's first commercial nuclear power station and the ways in which the Calder Hall type of station is being developed but also the research in progress on new and more efficient forms of fission reactor. The display has in fact been concentrated on those aspects of nuclear power which are expected to lead to sales of equipment during the next ten or twenty years.

The stand of the Nuclear Power Plant Co., Ltd., will consist entirely of an animated scale model of a complete 400 MW nuclear power station employing two graphite-moderated, gas-cooled reactors fuelled with natural uranium. An idea of the size of the model may be gathered from the fact that one of the reactor buildings will be used as an office. A model of the Hinkley Point nuclear power station, being built by the English Electric-Babcock & Wilcox-Taylor Woodrow Atomic Power Group for the C.E.G.B. will be a feature of the Babcock & Wilcox stand, which will be principally concerned with steam power as a factor in economic progress. Standard Telephones & Cables, Ltd., will show the contribution made by the company to telecommunications throughout the world.

Plessey Apprentice Training School

Speaking at a special ceremony for the presentation of prizes to apprentices employed in the Swindon factories of the Plessey Co., Ltd., Mr. A. E. Underwood, director, said that recently the company had made a step forward by equipping a separate bay of the factory for use as an apprentice training school.

He pointed out that the school, operating under the supervision of Mr. A. A. Steele, the apprentice supervisor, contained a wide range of machine tools and equipment, and first-year boys would receive full training, not only in how to operate a machine and its equipment, but also in the philosophy behind their application.

The number of apprentices now employed in the Swindon group of factories is 68, but this figure will be increased to approximately 90 next August.

E.T.U. Conference

The preliminary agenda has now been circulated for the annual delegate conference of the Electrical Trades Union, to be held at Morecambe from 19th to 23rd May. It contains 154 motions, many of them on old themes. Four, supported by 15 branches, are concerned with the withdrawal by the Ministry of Works and the National Federated Electrical Association from the apprenticeship scheme and the position of apprentices in the electrical contracting industry. A composite motion, sponsored by ten branches, supports the ban on working with unregistered apprentices. Two motions call for day release classes with pay for all apprentices, while another asks for a national apprenticeship scheme to be run by a Government Department.

On the much disputed question of Electricity Board contracting departments, one branch considers that the position has so much improved that the policy of not allowing contracting members to serve on works committees should be revised. A further motion is concerned with what it describes as the "ever-growing practice" of sub-contracting to private contractors, thereby threatening members in the electricity supply industry with redundancy.

Philips Scottish Headquarters

The Scottish regional headquarters of Philips Electrical, Ltd., at 26, Bothwell Street, Glasgow, have recently undergone extensive modernisation and re-styling. The external appearance of the building has been completely altered and the public showroom on the ground floor has been re-designed and brought up to date. Wall panels display a selection from the company's fluorescent, tungsten, mercury, sodium and special lamp ranges, and murals illustrate medical and industrial X-ray apparatus. Radio and television receivers, record playing equipment and tape recorders are displayed on stands, and a central gondola is devoted to the products of the electrical appliances division. A restful atmosphere is provided by fluorescent general lighting, ceiling and pelmet mounted, and by the liberal use of tungsten spotlamps.

The lamp store, which formerly

Part of the reconstructed Scottish headquarters of Philips Electrical, Ltd.

occupied the lower ground floor, has been moved to other premises and the space has been taken up by administrative offices and a commodious conference-cum-demonstration room. The room is sound-proof and is suitable for demonstrations of radio, television and sound-reproducing equipment, as well as for film shows, etc. It also constitutes a permanent working demonstration of practically all lighting fittings in the Philips range. The hearing aid centre is also on this floor. The showroom was designed by Mr. G. Loman, Dip.Arch., who, in consultation with the Philips lighting design service, was also responsible for the lighting scheme. Construction was by Camden Exhibition & Display Co., Ltd., London, electrical work by Grindlay Ross & Co., Ltd., Glasgow, and decoration by John Lindsay & Sons (Decorators), Ltd., Glasgow.

Prices of Materials

In the accompanying table we give the basic prices of the more important materials used in the electrical industry. The figures given are the selling prices and are those quoted on Tuesday last.

ALUMINIUM ingots	ton £197 0s 0d
COPPER, H.C. Electro	ton £163 15s 0d
Fire Refined 99·70%	ton £162 0s 0d
Fire Refined 99·50%	ton £161 0s 0d
COPPER Tubes ..	lb 1s 7½d
Sheet	ton £189 10s 0d
H.C. wire and strip ..	ton £214 5s 0d
LEAD, English ..	ton £74 10s 0d
Foreign	ton £73 0s 0d
MERCURY	flask £77 0s 0d
TIN, block (English) ..	ton £732 0s 0d
ZINC, G.O.B. Foreign	ton £62 10s 0d
Electrolytic	ton —
BRASS Tubes (solid drawn)	lb 1s 4½d
Sheet	ton —
Wire	lb 2s 2½d
PHOSPHOR BRONZE Wire	lb 3s 4½d
PLATINUM	oz £26 15s 0d
RUBBER, No. 1 R.S.S. spot	lb 22½d—23d

Digital Computer Conference

The Birmingham College of Technology is organising a series of one-day conferences on electronic digital computers and their industrial applications. The first, with special reference to Ferranti computers, will be held at the College at Gosta Green, on Wednesday, 26th March. The conference fee is £2. Further details can be had from the Registrar, College of Technology, Suffolk Street, Birmingham, 1.

Trade Announcements

Kenwood Electrics, Ltd., has taken over distribution of all Kenwood products in Scotland from its previous distributors, S. W. Cohen, Ltd., of Candleriggs, Glasgow. Kenwood Electrics has moved into new premises in 52-56, Carrick Street, Glasgow, C.2 (Central 8067), and Mr. D. Ross, who handled Kenwood products with S. W. Cohen, Ltd., has become sales office manager. Mr. T. Goldring, Kenwood's small appliance marketing division representative in the North of England and Scotland, becomes Scottish area sales manager.

Last year **Wild-Barfield Electric Furnaces, Ltd.**, Watford, entered into an agreement to manufacture vacuum arc, induction and resistance furnaces and vacuum analysers to the designs of the National Research Corporation, Massachusetts, U.S.A. There are in hand a considerable number of vacuum furnaces and to ensure that such orders may be proceeded with expeditiously, a new designs and production department has been created in respect of vacuum equipment.

FitzGibbon & Murray, Ltd., Ewell, Surrey, have been appointed sole United Kingdom distributors to Messrs. J. G. Mehne, Electrical Products. The range comprises ironclad and Bakelite bells, staircase switches, time switches, electric door locks, electric clocks and movements.

Mr. J. S. Brown has been appointed by Carron Company, Falkirk, to be its domestic electrical appliances representative in London and the Southern Counties, as from 1st March.

The Power Equipment Co., Ltd., Kingsbury Works, Hendon, N.W.9, switchgear manufacturers, have recently acquired the controlling interest in **Mickelwright, Ltd.**, Bridgewater Road, Alperton, Middlesex, which was established in 1912 and has specialised in the design and manufacture of resistances, contactors and switchgear, particularly in connection with cinema and theatre lighting. Mickelwright, Ltd., will retain its identity, but will now enjoy the advantages of the technical and design resources of the parent company.

The **Metropolitan-Vickers Electrical Co., Ltd.**, announces that from 24th March the postal address of its Sheffield district office will be 9, Market Place, Sheffield, 1. The telephone numbers will remain unchanged.

Kelvin & Hughes (Industrial), Ltd., has appointed Mr. W. Roddis as area representative for the East and West Ridings of Yorkshire, North Lincolnshire and North Derbyshire. His address is 38, Cambridge Street, Clifton, Rotherham, Yorks.

Mr. A. C. Stewart, A.M.I.E.E., has been appointed northern representative by **Porter Electrical Products, Ltd.**, Harrogate, for the "Portaway" earth-continuity and bonding system. He was until recently northern representative of Electronic Instruments, Ltd.

The Derby branch office of the **St. Helens Cable & Rubber Co., Ltd.**, is now at 156, Harrington Street, Derby (telephone: Derby 21288-9).

The new telephone number of the electrical appliance division of **Sutcliffe Clarkson, Ltd.**, Burnley, is Burnley 78283.

D. Robinson & Co. have moved to Gunnersbury House, 717, London Road, Hounslow, Middx. (telephone: Hounslow 6266-7).

Electrical Signmakers

THE principal guest at last Tuesday's annual luncheon of the Electrical Sign Manufacturers' Association at the Savoy Hotel, London, was Sir Frederic Osborn, chairman of the executive of the Town and Country Planning Association. Sir Frederic, in proposing the toast "Illuminated Signs," expressed his surprise at being asked to do so in view of his activities as a "planner." He gave his ideas of what he considered to be ideal signs and said that control by regulations could be only partially satisfactory; good signs could be produced only by good designers.

When electric light was properly used it could add immensely to the appearance of our cities. He would like to see an improvement in the choice and range of colours and in the lettering used for signs. We had not yet begun to make use of light in the decoration of our cities; this would provide an excellent outlet for the products of the signmakers.

In reply, Mr. K. J. Oldham, chairman of the Association, thanked Sir Frederic Osborn although he could not agree with all he had said. Mr. Oldham stressed the importance of commercial advertising and went on to say that the Association embraced both large and small firms who all tried to provide a better type of electrical sign. But because of their planning friends they were unable to increase their output. One big problem was the delay in securing planning consent. About 60 per cent of their signs were eventually approved but it generally took about two months, although in many cases the signs were urgently wanted.

The health of the guests was proposed in a witty manner by Mr. G. S. Campbell, vice-chairman of the Association, and the response was by Mr. G. R. Pope (commercial manager of *The Times*), chairman of the Advertising Association executive.

New A.E.A. London Offices

The United Kingdom Atomic Energy Authority has now moved to its new offices at 11, Charles II Street, London, S.W.1 (telephone: Whitehall 6262).

Ideal Home Exhibition

THIS year marks the golden jubilee of the *Daily Mail* Ideal Home Exhibition, now being held at Olympia, London. Many manufacturers are showing products for the first time and there is a wide range of such items as washing machines, refrigerators, cookers, cleaning apparatus, etc., from which to make a choice.

The theme of the British Electrical Development Association's display is "Get up to date—go electric" and some 130 electrical appliances are on view. No fewer than 21 different makes of electric cookers are available for inspection, 12 of which are automatic, and there are ten makes of refrigerators. At a special information centre visitors can obtain advice on electric water heating methods.

Many manufacturers choose this time of the year to introduce new products. The most noticeable trend is in the number of refrigerators on show. Prestcold introduce three new models, the D.301 "Packaway," the D.431 "Big Four" and the T.901 "Automatic Nine." The first-mentioned model, which can be installed even in the smallest kitchen, has attracted particular attention. With a capacity of 3·1 cu ft it has enough shelf space for a week's supply of foodstuffs for the average family; there is a separate butter compartment, room for four pints of milk in the door, and a meat or fish chill tray. Its dimensions are such that it can be kept under the draining board, built into a kitchen unit or even hung on the kitchen wall. The cabinet colour is in white or cream.

Another small refrigerator is the Lec Refrigeration 2 cu ft "Coronet." This model has been redesigned and it now has two shelves instead of one, increasing the shelf area from 2·7 sq ft to 3·6 sq ft. The company is also showing home freezers in 4 and 5·4 cu ft sizes and its 6 cu ft "International" de-luxe model. An absorption type refrigerator, the 3·3 cu ft "Alaska," is the latest product of Parnall (Yate), Ltd. This refrigerator stands at standard sink height (36in) and is available in all-cream or all-white. A red vitreous enamelled top can be obtained as an optional extra. The new Kelvinator models (4·7 and 6·5 cu ft) are both provided with ample door storage space, frozen food chests, and vegetable and fruit crispers. In keeping with others in this company's range, the finishes are either white or champagne ivory.

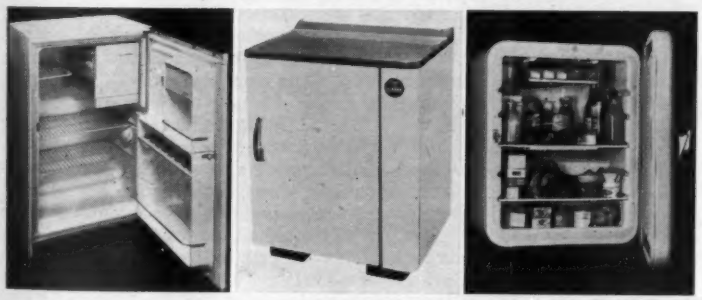
Section of the E.D.A. stand. The "small boy" symbol of the Association's 1958 water heating campaign is prominently featured

The two new refrigerators shown by the General Electric Co., Ltd., have full width stainless steel freezers, two-section meat and fish chiller trays, space for the storage of tall bottles, and doors with storage compartments for cheese and butter and racks for bottles, tins and eggs. They have a capacity of 6 and 8 cu ft, respectively, and are available in honeysuckle or white with carnival coloured interiors. Door finish of both refrigerators is of a synthetic enamel while the interior of the 6 cu ft model is finished in plastic on steel; the larger model has a vitreous enamelled interior.

Apart from refrigerators, the G.E.C. has introduced a new cooker with eye-level grill (see *Electrical Review*, 21st February issue) and a cylinder vacuum cleaner. The cleaner has many up-to-the-minute features including treble-air filters, throw-away dust bags and double insulation enabling it to be operated with safety from any socket outlet. The attachments comprise a floor and wall brush, carpet nozzle, upholstery tool, cornice brush and a crevice nozzle. There is also an upright cleaner to be seen, as well as a floor polisher.

The new lightweight Tellus vacuum cleaner, model R41, is shown for the first time. There is no dust bag, the dirt being collected in a metal dust container. In addition to general cleaning it is also suitable for such work as collecting ash, soot, broken glass, etc. The company's all-metal three-brush floor polisher is also shown. A multi-purpose suction cleaner, of Continental origin, shown by Vactite, Ltd., can be used as a vacuum cleaner, floor polisher, hair dryer or a hand cleaner.

Two new suction cleaners are to be seen on the stand of Vactric, Ltd. The first, model W303, is a cylindrical cleaner with a wide range of accessories including a spray gun, and a de-mothing device. The other is the R58 upright model fitted with an automatic latching handle, convenient foot switch, six-position carpet dial and headlight. A wide range of cleaning products, all fitted with the "Hooverflex" double-stretch hose is to be seen on the Hoover, Ltd., stand, while Electrolux, Ltd., shows its latest model 62 cleaner in



Left: Prestcold "Packaway" 3·1 cu ft refrigerator. Centre: Parnall "Alaska" 3·3 cu ft refrigerator. Right: Lec Refrigeration "Coronet" 2 cu ft model

Kelvinator model K65H 6·5 cu ft refrigerator

G.E.C. model DE.82 cu ft refrigerator

Right : Black & Decker model D.500 ¼in electric drill

Kenwood electric knife and scissors sharpener

Left : Bendix "Dialamatic" tumble action washer

Selecta Power Tools model 4,500 two-speed electric drill

addition to its already popular models 60 and 33, and the B9 floor polisher.

The British Vacuum Cleaner & Engineering Co., manufacturers of "Goblin" domestic appliances, is showing several cleaners including its "Ace" de-luxe model and "Regal" upright model equipped with revolving beater brush and searchlight. This company has also introduced a new vacuum clothes airer, a rapid drying machine capable of drying a full load of washing at one time.

The model 47H horizontal cooker being shown for the first time in public by Belling & Co., Ltd., has the oven alongside the boiling plates, avoiding the need to stoop and providing more storage space. Cooking facilities are the same as in the company's model 47AB, with the addition of an auto-timer, an electric clock and a four-hour timer. As well as a large hotcupboard beneath the hob, there are two storage cupboards in the base and a further cupboard above the oven for keeping plates and food warm. Another new model is the "Twin Baby Belling" with an oven similar to that of the "Wee Baby" but independently heated. It is large enough for the requirements of two or three people and has a 6½in boiling plate, grill boiler and a large grill compartment. Belling convectors include the "Zephyr" 1, 2 and 3 kW models, and the latest dual-control "Zephyr" with remote thermostatic control. Among new fires is a 3 kW "Medieval" period fire in 2 or 3 kW sizes, with log or coal effect, and the "Countess" 2 or 3 kW contemporary styled reflector fire.

Fires in every period from the Elizabethan to the present are shown by Berry's Electric Magicoal, Ltd., as well as water heaters and many new lighting fittings. Of special interest is a pin-up wall bracket fitting which can be hung like a picture. There are also "traditional" pendants and wall brackets including brass and silver chandelier fittings.

Permanently oil-filled thermostatically controlled radiators and, for short-term heating purposes, 750 W infra-red heaters, are available on the Dimplex stand. There is also a range of skirting board styled convectors which can be built up in multiples. All the Dimplex models are available in eight colours. Colourful convector heaters and an attractive range of electric fires in a selection of colours are displayed by the Jackson Electric Stove Co. Wash boilers and the "Jill" 3 and 1½ gal water heaters are also displayed as well as the company's latest electric cooker, the Jackson "Joy," with eye-level grill (see *Electrical Review*, 31st January).

The latest of the English Electric Co.'s wide range of domestic appliances is a new table top refrigerator with unusually compact external dimensions. Although it has a capacity of 3·6 cu ft and a shelf area of 6·7 sq ft it can be fitted flush into a space measuring only 20in wide. Meeting the housewife's preference for colour in the kitchen, the food compartment and inner door panel are of blue polystyrene with patches of kingfisher blue on the self-closing evaporator door. The guard rails on the bottle shelves are finished in a rich copper colour. Apart from refrigerators the English Electric Co. is displaying its "Homemaker" automatic electric cookers, washing machines, food mixers and plate warmers.

A new "Thor" automatic washer, completely re-styled and fitted with foot pedal controls has been introduced by Parnall (Yate), Ltd. It has a concealed water inlet spout and hinged glass lid and is available in white or cream with grey base and matching tub bands.

Unlike other Bendix machines, no special plumbing is required for the "Dialamatic" tumble-action washer which is being shown for the first time; connections to water supply and waste are made by flexible hoses. It has a built-in 3 kW immersion heater and in one continuous operation it washes the clothes, rinses, drains itself and spin dries. The latest "Gyramatic" automatic washer is also exhibited.

Dishmaster (London), Ltd., producers of dish-washing machines bearing this name, have recently merged with the Kenwood Manufacturing Co., and on the latter company's stand these machines can be seen demonstrated. As a first step towards bringing a dish-washing machine within the reach of British housewives Kenwood have reduced the price by over £20. The company also shows the "Kenwood-Wastemaster" kitchen waste disposal unit, and a domestic item claimed to be the first of its kind to be introduced in this country—an electrically operated knife and scissors sharpener. Finished in white with a

red button and dove grey rubber base it looks rather like a small electric iron.

The latest addition to the Easiclene domestic labour-saving devices is an automatic dish washer. It deals with saucepans, and even milk bottles in addition to the normal crockery pieces and presents them clean and dry. To illustrate the advantages of spin drying the Simplex Electric Co., manufacturers of the Creda "Debonair," are staging a series of special demonstrations on their gallery stand. Spin dryers can also be seen on the Chilton Products stand as well as a range of dry shavers, shaver sockets and the "Chilton" home hairclipper. Philips Electrical is displaying "Philishave" dry shavers, the "Ladyshave," health lamps and electrically heated blankets. On the Hotpoint stand there are washing machines, the models C36 and C50 refrigerators, water heating equipment, electric fires and kettles.

A new look has been given to the larger Servis "De-Luxe" and "Superheat" washing machines and the company also gives prominence to its recently introduced "Powerglide" model.

Electric tools are shown by several exhibitors, including S. N. Bridges & Co., whose "Handyman" drill is shown with all its accessories, including a floor polisher attachment. The "Homemaster Workshop," comprising three twist drills, a 6in saw blade and a ¼in router cutter is shown by Selecta Power Tools who, in addition, exhibit their "Powerpak Homemaster" unit and a new two-speed drill with $\frac{5}{16}$in capacity. The two speeds (2,500 and 4,500 r.p.m.) are made available by the turn of a key. Wolf Electric Tools, Ltd., is showing its new "Quarter-master" range of tools.

Among exhibitors of electric sewing machines are the Singer Sewing Machine Co., who include a model weighing only 12 lb; and Pfaff Sewing Machines-Bellow Machine Co., Ltd. The latest Pfaff model 230/260 portable machine is fully automatic and can buttonhole, turn and hem or embroider as many as 1,200 different designs.

Grid Stability Tests

THE presentation of the two papers dealing with grid stability tests before the Institution of Electrical Engineers on 6th March (see *Electrical Review*, 7th March) was followed by a discussion. The opener, Mr. L. Gosland (E.R.A.), said that the outstanding conclusion of the paper by Busemann and Casson was that normal methods of system analysis were entirely adequate. The adverse effect of flux decay on stability showed the beneficial effect of a powerful and fast-acting voltage regulator which was capable of maintaining the flux. One might visualise a sophisticated computer which picked up information from various points on the system and caused a suitably powerful excitation system to hold the field at its optimum value.

The work described had achieved its immediate object in regard to turbo-alternator systems, and one could now speak with authority on the stability of such systems. Problems of stability decreased with increase of power density and were probably not preoccupying the Central Electricity Generating Board at present. The most immediately profitable application of the results would probably be in export markets. There might be need to undertake similar tests in connection with hydro machines, where all appropriate factors had their relative orders of magnitude changed and the types of machine and of governor were different.

Mr. F. J. Lane (formerly C.E.G.B.) emphasised the need to give information to and obtain the co-operation of the staff at all levels likely to participate in these tests, and to control the enthusiasts who flocked to the scene and wanted various devices tried out. One way was to give them all jobs to do, even if it was merely reading ammeters. The control of all switching, earthing and so on should be in the hands of one man.

The conclusions of the paper by Busemann and Casson ought to have been more definite so that anyone interested could use them in his own studies. In the paper by Last, Mills and Norris the authors stated "It is of interest to note that no protective relays operated incorrectly during the tests." Coming from people largely responsible for the operation of protective gear, that struck a dismal note.

M. Magnien (Electricité de France) described the French micro-network, on which they had been asked by the C.E.G.B. to study certain aspects of the stability problems set by the tests under discussion. He agreed with Busemann and Casson in ascribing the most important part of the differences between the results of the actual tests and those of the micro-network tests to the losses, during short circuit, which were different for the actual machine and the micro-machine. The losses when short-circuiting the machine had a great influence on the elimination times only when the fault was electrically quite close to the machine. This influence was the greater as the power supplied before the short circuit was smaller, since as an absolute value short-circuit losses were practically independent of the initial load condition. To make the micro-network studies of value the losses of the micro-machines should be reduced. Regarding stator losses the micro-machines were over-dimensioned in such a way that the d.c. resistances of the stator windings were in relative values equivalent to those of the large machines, but the extra losses in the stator were much higher.

Mr. W. N. C. Clinch (C.E.G.B.) said that if he had been one of the control engineers he would have been frightened to see the instruments behave as they did. He wondered whether the manufacturers had been interested to see what their plant could do, and whether the machines had been specially adapted for the occasion.

More Information Needed

Professor M. W. Humphrey Davies (Queen Mary College) dealt with the tests for ascertaining the possibility of resynchronisation. He thought the authors were right in concluding that the present assumptions about stability investigations were justifiable for the sort of purposes for which they used them, but the tests showed that more information was required before knowing how much value to put on the results. Further tests should be done on salient-pole machines. As an occasional operating condition asynchronous operation had to be faced, and to get resynchronisation some alteration must be made to governing gear.

Mr. T. M. Whitelegg (A.E.I.) suggested that the alarming performance of the generator panel instruments might not be so serious in practice, as it would take some time for the control engineers to decide what had happened, by which time the oscillation might have died down. The tests at Cliff Quay had provided an all too rare opportunity

to test the analyser results, which for the type of system in question were reliable. He hoped an opportunity would be afforded to test analyser results for other types of system.

Mr. R. E. Martin (C.E.G.B.) supported the use of a simulator for training control staff. It could change the characteristics and simulate different types of machine more readily than by having to go to different generating stations in each case. As one who had organised a number of tests on the network, he emphasised the need for a properly defined line of responsibility, co-operation and safety, for good communication facilities and for really reliable instrumentation, which should be mounted in a vehicle, so that it could be set up in the laboratory and transported to the job.

Mr. D. R. Fenwick (Metro-Vick) said that steady operation with the sort of voltage regulator in question beyond 90 deg power angle was not likely to be possible unless no disturbances whatever were present. Any unstable system could run for some time in a steady state, but it could not be considered to be stable, because the first disturbance would start swinging.

Mr. B. Adkins (Imperial College) said that simulation by network analyser or micro-machine could be regarded either as a means of representation of the system to find out how the system worked or as a means of making the calculations required by the theoretical approach. At Imperial College they were using their micro-machines to find out why things happened; they took some condition of the kind covered by the tests under discussion, calculated what would happen from theory, did some tests and compared the results. This enabled them not only to check the theory but also to suggest means of simplifying it. Mr. J. S. Vosper (E.R.A.) gave a brief account, by means of slides, of the measurement of switching transients at Cliff Quay and the results obtained.

Dr. P. D. Aylett (C.E.G.B.) expressed the opinion that in this country almost any generator would resynchronise following a fault. If this was confirmed by further investigations it might drastically alter our methods of design of the power system. A governor could give negative damping, pumping power in when it should be taking it out. They had tried to get some idea of how governors performed and of their mathematics, but the designers and manufacturers did not seem able to tell them. A good deal more had to be known about what the governor did at the various frequencies it was likely to encounter. The tests described had encouraged the Generating Board to carry out a great number of others on which they hoped to report in the near future. They found that the turbo-generator was a very good machine and would nearly always resynchronise, so that conditions which might appear dangerous to the operator were much safer than they looked. He recommended tests to show operators how, by taking simple action, they could restore the situation. Mr. E. B. Powell expressed the hope that in any further tests a full-scale investigation on governors would be included.

Screw-Thread Practice

B.E.A.M.A. COUNCIL RECOMMENDATIONS

A STATEMENT on "Standard Screw-thread Practice in British Engineering and the Use of Unified Screw Threads" has been widely circulated by the British Electrical and Allied Manufacturers' Association (36, Kingsway, London, W.C.2) both to its members and in the engineering field generally. Its purpose is to explain why the B.E.A.M.A. Council and its Standardisation Committee consider that the use of British Whitworth and British Association threads should continue to be the standard practice of the industry.

The statement, which takes the form of a four-page booklet, sets out the circumstances in which, in connection with wartime production, representatives of the United States, Canadian and British Government agencies agreed upon a unified screw-thread. It is contended that the use of this thread as a standard for the home and export markets of British industry is another matter.

For economical production of normal plant and products a standard interchangeable screw-thread is essential and it is also essential to maintain goodwill and acceptance of the industry's products in world markets. While the electrical industry as one of the largest British exporting industries would welcome a world standard system the International Standards Organisation has been unable to secure agreement on one recommendation and is considering recommendations for both an inch and a metric systems. The Whitworth thread has not been put forward for consideration; the inch thread being considered is the unified thread based on American practice.

The recent adoption of the metric system by Far Eastern countries, coupled with European integration, may increase the demand for metric screw-threads, although the British Standard Whitworth thread is probably more widely used throughout the world than any other.

It is suggested that the time to consider any change will be when the I.S.O. makes its final recommendation. Then if a change seems necessary or desirable it must be planned with economy and the minimum inconvenience in view. Individual and conflicting decisions must mean that the many advantages of a standard interchangeable screw-thread will no longer be available; there must be co-operative consideration of the problems as they will affect the future well-being of the whole industry.

Therefore the Council does not favour any change-over to unified screw-threads at present and it recommends the continuation of the B.E.A.M.A. 1952 policy of using British Standard Whitworth and B.A. threads. Customers wishing to depart from the practice should be told of the mutual advantages of accepting standard products. Where Whitworth and B.A. threads are not the generally accepted standard, other threads should be supplied but only when the customer asks for them or it is considered expedient for expanding export trade. For special equipment for the Armed Forces unified screw threads should still be supplied where they are firmly demanded.

Construction Work Lighting

ACCIDENT prevention and safety of persons employed on building operations at night is the subject of a paper by Mr. J. Gordon Scott presented at a meeting of the Illuminating Engineering Society at the Lighting Service Bureau, London, on 11th March. Not only is there a legal obligation to provide good standards under the Factories Act but the lack of suitable lighting has been the cause of many accidents. The author suggests that the more permanent lights should be operated at 110 V and portable lamps at 25 or 12½ V.

Mercury-Arc Invertors in Induction Heating*

By D. L. SMART, B.Sc.Tech., A.M.I.E.E., and J. J. L. WEAVER, A.M.I.E.E.

IN suitable applications the induction method of heating metals may offer ease of control, fast heating times with low scale formation and low standby losses. Medium frequencies from about 1 to 10 kc/s are used where the relatively small size or non-magnetic nature of the work-pieces makes 50 c/s induction heating ineffective, and where it is not desired to take advantage of the surface heating effect given by radio frequencies.

The normal method of generating medium-frequency power is by motor-alternator sets, but the possibility of producing a range of these frequencies by mercury-arc invertors has presented an interesting technical challenge to arc-rectifier engineers for many years, and following earlier experimental work, a few equipments were built by overseas manufacturers for this service. The paper covers the general operation of medium-frequency invertors and describes a new approach to the design of suitable invertor valves and control circuits. The upper frequency limit of 1,000 to 2,000 c/s so far achieved in power invertors makes them unsuitable for the heating of very small workpieces, and development was, therefore, concentrated on equipment with outputs of 100 kW upwards.

Fig. 1 shows the main circuit used, in which each phase of the supply transformer feeds a separate single-phase,

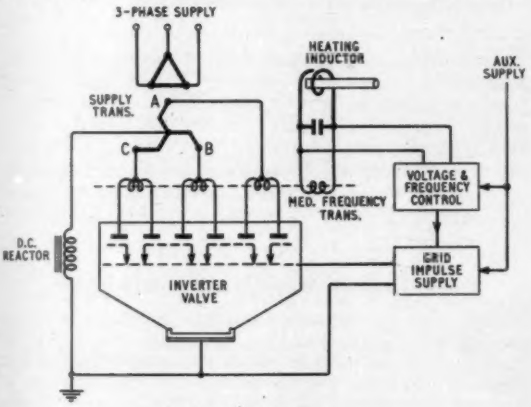


Fig. 1.—Main circuit of invertor

two-anode invertor, the medium-frequency windings of which are all wound on a common output transformer. As each supply phase becomes the most positive, current flows in that phase and its associated invertor for approximately one-third of a cycle, until conduction is taken over by the next phase. During each conduction time the two anodes concerned are, of course, carrying the current alternately at the medium frequency.

It will be seen that the current waveshapes in the supply transformer are the same as for a three-phase rectifier transformer; the circuit also generates the same average direct voltage as a rectifier, acting to maintain the cathode current. This voltage is opposed by the back e.m.f. of the invertor circuits, which thus absorb power from the supply. The circuit is completed by a d.c. reactor, which absorbs the instantaneous difference between the "rectifier" and "invertor" voltages, and maintains a steady direct current.

The a.c. medium-frequency system supplied by the invertor is the oscillating circuit consisting of the heating inductor, which may have a power factor of 0·1 to 0·4, and the output capacitor. Normal operation of the invertor is very similar to invertor operation on a power system, with the capacitor supplying the necessary reactive power to correct the load to unity power factor at the operating frequency, and to provide for invertor commutation.

One cause of variations in operating conditions is the wide change which may take place in the load coil inductance during heating or melting processes. With a fixed frequency supply this may be compensated by the provision of contactors to vary the value of output capacitor in circuit, but with an invertor it is easier to vary the operating frequency to maintain the correct tuning of the circuit. The control circuits must, therefore, cater for

* Summary by the authors of an I.E.E. Utilisation Section paper, "The Use of Steel-Tank Mercury-Arc Invertors for Generating Medium Frequencies for Induction Heating," presented on 13th March. Mr. Smart and Mr. Weaver are with the English Electric Co., Ltd.

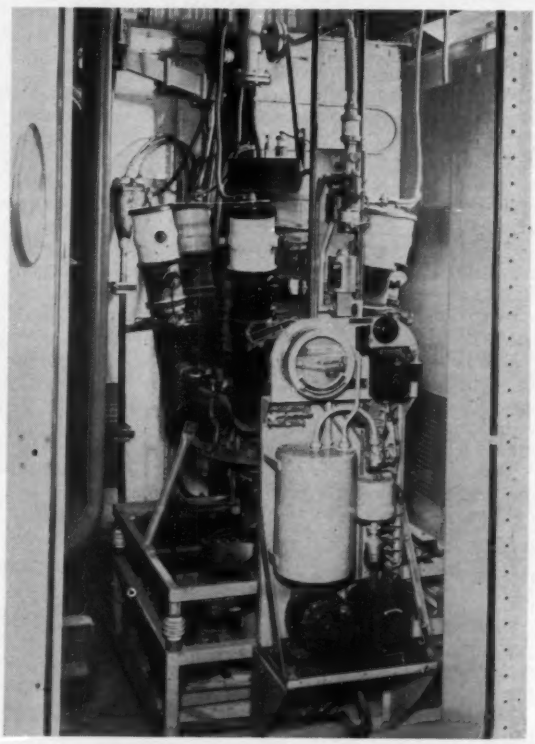


Fig. 2.—Invertor valve for high-voltage six-anode steel-tank rectifier

these variations in frequency, and must also be capable of controlling the operating voltage of the output circuit if required and of starting the invertor action.

In the system described in the paper, all the control functions are covered by the use of an electronic grid control unit designed for reliable operation and easy checking or maintenance. Medium-frequency grid pulses of constant amplitude are provided by a variable-frequency multi-vibrator and amplifier, and the frequency is automatically controlled to follow variations in the load circuit tuning.

Output voltage control is effected by delaying the application of grid pulses to the pairs of grids associated with each supply phase. This delays the start of conduction on each phase, and reduces the effective average direct voltage applied to the main circuit in exactly the same way as for a three-phase grid controlled rectifier.

The starting of inversion may be done in a number of ways, but it has been found that normal output circuits can be started quite satisfactorily by suitable arrangement of the frequency and voltage settings. Switching-off and automatic high-speed protection are also provided by grid control of the invertor. Thus, all normal starting, stopping and control operations are done entirely by the electronic grid control circuits and their associated relays, without requiring the provision of contacts in any of the main power circuits.

Fig. 2 shows the type of valve used. This is based on a design of high-voltage, six-anode, steel-tank rectifier, and can be used with cathode currents up to 80 A d.c. and peak anode voltages of about 30 kV. As the peak voltage may sometimes rise to 8½ times the effective d.c. voltage of the supply circuit, the latter is limited to 4 kV d.c. or less, and the maximum output power available is about 250 kW at 1,000 c/s, or less at higher frequencies.

One of the principal limitations on the output of a medium-frequency invertor is the de-ionising time which must be allowed after an anode stops firing before the grid can regain control and prevent the anode from firing again. The comparatively low current of the valves, combined with a special grid design, was chosen to make it easier to obtain the very short de-ionising times of 30 to 80 microsec required. The valves are equipped with small automatically protected vacuum pumping sets (shown with the covers removed), and have operated for periods up to several thousand hours without detectable deterioration, in spite of the high frequency and voltage of operation.

Equipments

Descriptions are given of a 100 kW 1,100 to 1,400 c/s equipment supplying a steel-alloy melting furnace and of a 200 kW 1,000 to 1,200 c/s equipment feeding a number of heating stations in a forging shop; these are equipped with automatic grid control to switch the invertor on only when one or more of the stations is loaded.

LETTERS TO THE EDITOR

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for the opinions expressed by correspondents.

Bakelite Lampholder Fault

AFTER reading the criticisms of B.S. 52 : 1952 in the correspondence columns of your journal, not only recently but over the years, one wonders whether the august gentlemen comprising this particular Standards Committee ever trouble to read the technical Press. Perhaps they dwell in ivory towers and never suffer the frustration of attempting to unscrew jammed shade rings.

There must be very many thousands of these faulty moulded lampholders installed and all conforming to B.S. 52. One only has to examine those sold in the chain stores. It is idle for the B.S.I. to claim that a B.S. only specifies minimum requirements. To most people products with a British Standard mark are definitely quality goods. In the case of lampholders, that ultimate link from the power station to the electric light, if the Institution is not to fall into disrepute a revision of B.S. 52 which would specify a trouble-free holder is long overdue.

I would add that, as a palliative, oil run in between the threads does sometimes allow the ring to unscrew.

Edgware, Middx. MICHAEL NEIDLE.

Off-Peak Tariffs

I HAVE read with considerable interest the report of Sir Christopher Hinton's speech at the Electrical Contractors' Association dinner, and it was gratifying to learn that he considers an improved load factor essential to the economics of generation and to the development of nuclear power plants.

Whilst one appreciates Sir Christopher's appeal to electrical contractors to persuade their customers to use electrical energy at off-peak periods in order to improve the load factor, consideration should be given to a reduced tariff being offered to consumers for off-peak use in domestic premises. It is only thus that sufficient demand will be created to attain that efficiency that is so desirable. Sir Christopher may rest assured that electrical contractors will make consumers fully aware of any benefits that can be obtained if a tariff is available for off-peak domestic use.

Liverpool, 15. T. R. JONES.

Mechanical Handling Exhibition

MORE than 250 exhibitors will be participating in the biennial Mechanical Handling Exhibition being held at Earls Court, London, from 7th to 17th May. For the first time, the exhibition will be international. In addition to its many thousands of exhibits, there will be a convention of speakers drawn from many countries. Exhibits include all types of industrial conveyors, elevators and stackers, hoists and pulley blocks, pneumatic handling plants, coal handling plant, fork-lift and other industrial trucks, cranes and a wide range of accessories and appliances associated with mechanical handling.

Admission tickets can be obtained free on application to Mr. H. A. Collman, *Mechanical Handling*, Dorset House, Stamford Street, London, S.E.1.

International Convention on Transistors

THE Institution of Electrical Engineers is organising an international convention on transistors and associated semiconductor devices, to be held in London from 25th May to 29th May, 1959. Further details will be announced later.

NEW ELECTRICAL EQUIPMENT

High Fidelity Telephone System

An internal telephone system which will operate for six months to a year, on two ordinary 4·5 V torch batteries is announced by CASS ELECTRONICS, LTD., White Hart Yard, Guildford Street, Chertsey, Surrey. Up to three sub-units can be connected to each "Dialog" master unit.

To call a substation from the master unit the appropriate button is pressed followed by the "speak" button. Conversation can be maintained with the speaker up to ten yards from the

Cass Electronics "Dialog" internal telephone

instrument with high fidelity reproduction. The "Dialog" equipment will operate for distances up to 200 yd. General announcements can be made by the depression of three buttons on the master unit and sub-units can call the main unit. A substation with listening switch is available to enable the caller to be heard but the master station cannot listen in to the substation if the switch at the substation is in the off position.

The master and sub-unit, complete and ready to install, cost £24 and the price of the master unit with three sub-units is £31.

Control Rod Indicator

An accurate remote position servo driven control rod indicator is announced by the SPERRY GYROSCOPE CO., LTD., Great West Road, Brentford, Middlesex. The indicator presents the positional information obtained from a synchro transmitter in three forms. A diamond-led sector gives information of the rod position proportional to full transmitter movement; the digital presentation provides a precise reading of the transmitted position; and a "tell-tale" dial indicates the presence and direction of slow movements.

Pneumatic Timer

A narrow base pneumatic timing relay is now available from SQUARE D, LTD., 100, Aldersgate Street, London, E.C.1, the a.c. type B for surface and flush mounting, and the d.c. type C for surface mounting. Both models are available as an enclosed device for mounting with other equipment on a control panel. The flush mounting timer has been added to the range for applications where external timing adjustment is necessary.

Invertible magnets permit a.c. timers to be converted from time delay after energisation to time delay after de-energisation and vice versa. This is done by turning the magnet and guide assembly 180 degrees by removing and replacing the two screws holding it to the baseplate.

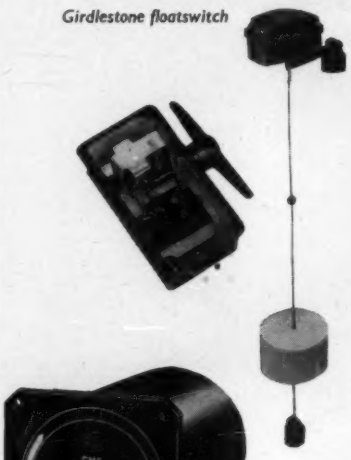
Both a.c. and d.c. timers can be supplied with either a knurled adjusting knob or a micrometer type adjusting dial for timer adjustment. The knurled adjusting knob indicates slower or faster timing. The micrometer type adjusting dial provides accurate visual indication of the timer setting to the nearest one-tenth turn of the operating knob accuracy. The range of adjustment provided is from 0·2 second to three minutes in an infinite number of steps.

Floatswitch

A mercury switch is incorporated in the cast iron weatherproof case of the type MS-5 floatswitch made by GIRDLESTONE PUMPS, LTD., 23, Davies Street, London, W.1. The mercury tube is carried in a phosphor-bronze cradle which is actuated by means of a positive spring controlled tilting mechanism.

Expanded polystyrene floats suitable for liquids up to a temperature of 150 deg F are supplied as standard equipment. The principal advantage of this material is that the buoyancy of the float is not affected by damage caused through abrasion impact or ice. Float gear can be supplied in copper for hot liquids (exceeding 150 deg F) and in stainless steel or polythene for certain acids and corrosive fluids. The switch rating is 5 A at 250 V a.c. or 2 A at 500 V a.c.

Girdlestone floatswitch



Sperry control rod position indicator

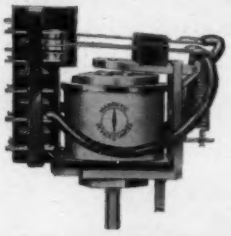
Transistor Tester

A general purpose tester for p-n-p junction and point type transistors is announced by AIRMEC, LTD., High Wycombe, Bucks. It is mains operated and enables static tests to be carried out up to a current of 40 mA and a maximum collector voltage of 80 V. In addition, certain small signal parameters are measured directly by a bridge method at a frequency of 420 c/s. From these measurements simple calculation will give the remainder of the usual transistor parameters.

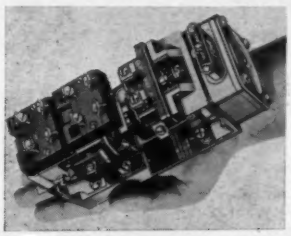
This instrument incorporates its own bridge oscillator and detector, and facilities are provided for the connection of an external oscilloscope to check for linearity of the small signal measurements, or telephones for aural bridge balance detection.

A.C. Relay

A small, low price a.c. relay is announced by MAGNETIC DEVICES, LTD., Exning Road, Newmarket, Suffolk. The Series 320 relay is restricted to a few standard contact arrangements (maximum three pole). For this reason and because it is designed for medium requirements, it will handle loads normally carried by much larger relays and is generally recommended for switching inductive circuits. The contacts can carry loads



Magnetic Devices Series 320 relay



Square D pneumatic timer

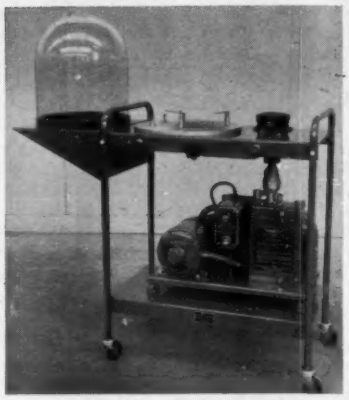
of up to 10 A at 250 V a.c. or 30 V d.c. (non-inductive).

The relay can be supplied with standard coil windings for 6, 12, 50, 110 or 250 V working. The coil rating is 5·5 VA. Vacuum impregnated coils can be supplied for tropical and humid conditions and the relay is built generally in accordance with M.O.S. Specification DEF. 5000. A hermetically sealed type is available and the relay is also to be produced with a dust cover and screw-type terminals on a moulded base.

Vacuum Impregnating Unit

A vacuum pumping unit for the "potting" and impregnating of electrical circuits with epoxy resins is announced by EDWARDS HIGH VACUUM, LTD., Manor Royal, Crawley, Sussex. This simple and inexpensive pumping unit is suitable for both degassing and embedding. The unit is mounted on a standard two-shelf metal trolley. The top shelf houses the vacuum chamber, a hard glass bell jar 11½in i.d. and 13¾in high, sealed to a steel baseplate by means of an "L" shaped rubber gasket. Two electrodes are fitted in the baseplate so that the power supply for heating can be introduced into the chamber. A "Speedivac" 1SC150A air ballast rotary pump complete with motor is fitted on the bottom shelf.

An isolation valve mounted between the pump and baseplate enables the bell jar to be left under vacuum and the pump switched off. An air admittance valve and needle valves are included in the vacuum line, the former for bringing the chamber up to atmosphere and the needle valve to admit small quanties of air into the bell jar if degassing becomes violent. Vacuum measurement is provided by a 0-760 mm Hg barometrically compensated dial gauge mounted by the side of the bell jar on the top shelf.



Edwards vacuum impregnating unit

Studio Lighting Units

TO meet the needs of television and studio lighting engineers a new range of lighting units is being developed by the General Electric Co., Ltd. The first of these to be announced are two spotlight fittings designed to house 2 kW and 5 kW lamps respectively. Construction is of steel, all joints being welded, and they have a smooth external appearance free from projections. The cooling system is specially designed to allow air to pass through the unit at whatever angle it may be operated.

A new bi-post lampholder has been designed with improved contacts, the tension of which can be adjusted quickly to ensure that the lamp is securely held at all operational angles. This new holder also carries a spherical backing reflector, thereby forming a complete optical unit. The whole lampholder assembly can be removed from the unit easily to facilitate adjustment of the contact tension.

Each unit can be supplied with two alternative versions of "yoke" for mounting, one of which houses a newly designed self-locking system which enables an operator standing on a studio floor to "tilt," "pan," "focus" or "switch" a unit, which would otherwise be inaccessible, by using a light aluminium pole. This remote control operating pole terminates in a square sectioned socket which has a bell mouthed skirt to enable the control points on the unit to be engaged easily. The socket is connected to the pole by a flexible coupling to enable the operator to work from positions around a unit. When the pole is rotated to obtain the movement required it locks itself to the lighting unit, and when rotation ceases the pole frees itself automatically and can then be withdrawn. Alternatively, units can be supplied with a conventional yoke which terminates in a spigot, the lamp housing being locked to the yoke by a single side clamp. The fittings, complete with remote control yoke, weigh 27 lb and 60 lb respectively.

Left: Adjusting a 2 kW spotlight from a studio floor, using a remote control operating pole

Below: The G.E.C. 2 kW spotlight showing the bi-post lampholder and spherical backing reflector which form one complete optical unit

Specially designed accessories including "barn doors" and "snoots" are available, and these accessories fit into a small channel section which is an integral part of the front door of each unit. The diffuser lugs used previously, which proved highly vulnerable in practice, have been dispensed with, and this new method of holding accessories makes it possible to keep the lens of a unit completely unobstructed when a "barn door" is fully open.

In addition to the normal accessories the G.E.C. can also supply a new design of "barn door" which can be rotated and its doors positioned by means of the remote control operating pole.

PARLIAMENTARY REPORT

Rating of Boards' Premises

Under the Local Government Bill, which is now being considered by a Standing Committee of the House of Commons, all premises occupied and used by an Electricity or Gas Board wholly or mainly for the sale, display or demonstration of apparatus or accessories will be rated after 31st March, 1959, on the same basis as any other commercial premises and rates will be paid direct to the local authority. They will not come within the calculation of the "pool payment" from the electricity and gas undertakings generally.

In the Standing Committee on 4th March Mrs. Eveline Hill moved an amendment to make the new rating provision apply in addition "to any shop, room or other place occupied and used by a Gas or Electricity Board wholly or mainly as an office, not being a shop, room, or other place forming part of a hereditament occupied and used as a gas works or an electricity generating station." She said that although authorities were glad there was to be some alleviation of rating anomalies by the new rating of showrooms, it could happen that large establishments would pay only a proportion of what would otherwise be the commercial value of the premises which they occupied. As an example she cited Bankside House, in Southwark.

Replying, Mr. Henry Brooke, Minister of Housing and Local Government, said that at present the gas industry as a whole was represented on a basis of about £5,500,000, and the electricity industry about £11,250,000. Taking out the showrooms would cause a reduction of about £300,000 in each of those figures. Showrooms would receive the benefit of the 20 per cent derating under the 1957 Act and would, therefore, be rated on a figure of about £240,000 rather than £300,000.

Clauses 10 to 13 in the Bill arose from a searching investigation made by the Powell Committee, on which were representatives of the local authorities, and the gas, electricity and transport industries. That Committee reached the conclusion that it would not be right to do what was proposed in the amendment. The matter was examined again by the Working Party set up in 1957 to help with the technical proposals in the Bill and they also came down against what the amendment proposed to do. Without going into detail, he could say that their reason was based on historical facts. Before nationalisation, the undertakings had what was called a "cumulo" for rating purposes, but normally the showrooms were excluded. It was only after nationalisation that these were brought in.

The Government strongly opposed any breaking up of the nationalised undertakings for rating purposes. In view of the debate, however, he would undertake to consult the nationalised undertakings and local authorities again, inviting their attention to the views expressed by the Standing Committee. At the Report Stage he would let the committee know the result of the consultations.

The amendment was, by leave, withdrawn.

An amendment moved by Mr. Moss to the Clause dealing with transitional adjustments to give greater benefits to authorities which had power stations in their areas was negatived.

Disposal of Radioactive Waste

Replying to Mr. Roy Mason, the Prime Minister (Mr. Macmillan) said that the radioactivity of waste released from the civil nuclear power stations was expected to be negligible, but a panel of the Radioactive Substances Advisory Committee was reviewing present legislation to see whether it required to be strengthened or amended.

Reducing Corrosion

Mr. Robert Elliott asked the Parliamentary Secretary to the Ministry of Works, as representing the Lord President of the Council, what major advances the Chemical Research Laboratory had made in research to reduce wastage caused by corrosion.

Mr. Harmar Nicholls said the Chemical Research Laboratory of the Department of Scientific and Industrial Research had discovered corrosion inhibitors for metals in storage and in transit, and also in engine cooling systems. The Laboratory had also discovered methods of preventing premature failure of tubes in marine boilers.

Automation in Industry

In answer to Mr. J. C. Jennings, the Parliamentary Secretary to the Ministry of Works (Mr. Harmar Nicholls) said that the National Physical Laboratory was now turning its attention to the automatic control of the flow of work in factories. Completely new principles for the automatic control of machine tools and for process control in the oil industry were being investigated.

Nuclear-Powered Ships

In the debate on the Navy Estimates, Mr. Allan, Financial Secretary to the Admiralty, said that the strategic importance of atomic submarines from which ballistic missiles could be launched had made the project for building the first atomic-powered submarine more urgent, but spectacular progress could not be expected because of the largely experimental nature of the work. The zero energy reactor "Neptune" was operating, its purpose being to enable scientists to work out the basic problems connected with the high-pressure, water-cooled reactor. Operating experience had been highly satisfactory.

The construction of the Admiralty experimental site at Dounreay had gone according to plan, and the main building for the prototype reactor and its machinery would be finished by May.

Replying to the subsequent debate, Mr. Galbraith, Civil Lord of the Admiralty, said that in addition to the submarine project, the Government intended to go ahead at the same time with nuclear propulsion for merchant ships. The committee of which he was chairman, formed less than a year ago, had examined many nuclear propulsion systems to see whether any of them could be put straight into a ship without first building a prototype on shore. It had proved impossible.

The A.E.A., in collaboration with the various shipping interests, was now engaged on preliminary work on this project. What they wanted to do was to build an economic, or near-economic, ship to start with. His committee were now giving priority to an advanced feature of atomic technique which it was hoped would pave the way for the development of a smaller unit suitable for ship propulsion. "I hate to give an estimate, but if everything goes well—and in this kind of work there is no saying whether it will—we think there might possibly be a ship in the water by about 1964 but I should not like to be held down to that date," he added.

Smoke Measurement

Mr. Nicholls informed Mr. Leavey that the D.S.I.R. research station had devised two new types of instruments to simplify the measurement of smoke. One would enable a stoker in the boiler house, and the other a smoke inspector outside, to know when smoke darker than the legal limit was being produced. The research station had developed successful smoke eliminating devices for industrial hand-fired boilers.

Finances of Cable & Wireless

The Assistant Postmaster General (Mr. Thompson) told Mr. Rodgers that he saw no justification for a special commission, either in the financial record of Cable & Wireless, Ltd., or on other grounds. It was believed that the tariffs which had been in operation since last October would result in a satisfactory out-turn to the company. These tariffs were on average only 80 per cent above those of 1939, and few services could point to such a good record.

GENERATION AND DEVELOPMENT

South of Scotland Board's £500,000 Profit

The annual report and accounts of the South of Scotland Electricity Board for the year ended 31st December last, published this week, show that the Board's total income was £34·4 million and there was a surplus on the year's trading of £518,000, equivalent to 1·5 per cent of income. General reserve now amounts to £2 million, with a balance on the revenue account of £272,000. Capital expenditure in 1957 totalled £19·24 million, of which about 40 per cent was provided from internal resources.

New generating plant was brought into commission at Dalmarnock (60 MW), Barony (30 MW) and Dunfermline (12·5 MW). The generating plant programme was extended to 1965, by which time an additional 1,570 MW of plant will have been brought into service.

The 1957 maximum demand was 1,518 MW, an increase of 8 per cent, while sales rose by 5 per cent to 5,562 million kWh. The number of consumers at the end of the year was 1,297,000, an increase of about 30,000.

A fuller summary of the Board's report will appear in our next issue.

Lightning and Supply Interruptions

At a meeting of the East Midlands Electricity Consultative Council at Nottingham last week Mr. A. G. Connell, the chief engineer of the Board, spoke of the problem of interruptions in electricity supplies caused by lightning. Over the past six years, he said, lightning faults had accounted for fewer than one-quarter of the total faults on the Board's system. Last year, however, had been the worst on record; in the six months from 1st April there had been no less than 1,570 faults in the Area due to lightning.

Mr. Connell gave details of various measures which were being taken to minimise the effects of lightning on overhead line systems, such as the provision of automatic reclosing circuit-breakers.

The East Midlands Board was working with other Electricity Boards and the Electrical Research Association on the problem of lightning strokes. Whilst preliminary deductions had been made, firm conclusions could only be reached after long study.

Plymouth Reinforcement

Work is to begin next month on the third and final stage of the South Western Electricity Board's major reinforcement project to double the capacity of the existing network in Plymouth by increasing the system voltage from 6·6 to 11 kV. The final stage, costing about £85,000, covers the east and south-east of the city. The whole project involves an expenditure of £207,000.

OVERSEAS

Bulk Supply from Uganda to Kenya

The bulk supply of electricity to Kenya from the Owen Falls hydro-electric power station in Uganda was formally inaugurated on 3rd March. The Governor of Uganda, Sir Frederick Crawford, spoke from Owen Falls to the Governor of Kenya, Sir Evelyn Baring, in Nairobi, and the speeches were relayed by carrier current over the 323-mile line.

Sir Frederick said that this ceremony marked the official opening of the 132 kV link between the two territories and the provision of a bulk supply of electricity from Owen Falls to the Kenya Power Company. The agreement between the Uganda Electricity Board and the company was for a supply of electricity up to a maximum of 45,000 kW and he mentioned that the maximum demand supplied to Kenya had already reached 14,000 kW. Since the new supply had started on 1st January of this year it had been continuous and had suffered no interruptions from the Uganda end.

The chairman of the Uganda Electricity Board, Mr. W. D. Fenton, said that for some reason or other there was a tendency to regard the exporting—and indeed importing—of electricity with some suspicion in many places—and yet once a connection was established between two territories, hydro-electricity was one of the simplest forms of export. It was not a wasting asset. With a large storage lake like Lake Victoria, they in Uganda were not affected electrically by droughts. This year they expected to get well over £100,000 from the export and in another few years its value to Uganda would be about £600,000 a year. It would have been impossible financially and economically to have embarked at the present time on distribution to Masaka, Soroti, Busoga, Mityana, Kibanga Port Area, Mount Elgon to Palissa—and so on, without the guarantee of revenue from export.

"We are proceeding as quickly as finance, labour and materials will allow, but I for one will only be satisfied if, during the few years I am in Uganda, some of the benefits of this export are brought to the up-country areas. There is no reason why, just because of geography, people living within reach electrically of Owen Falls should get all the advantages," he added.

Referring to some criticism which had recently been made in Uganda about the need for a second dam, he said that if a country embarked on a modern way of life, there was no going back. They had scarcely scratched the fringe of electrical development in the country.

Sir Amar Maini, Minister of Corporations and Regional Communications, who is responsible for the Uganda Electricity Board activities to Legislative Council, said that the potentialities of exploiting the Victoria Nile between Jinja and Lake Albert were enormous. Preparations for the next step were already in hand.

Last week the circular coffer dam of the Kariba hydro-electric project in Rhodesia was swamped when the level of the Zambesi River, already 100ft higher than normal, rose to a new peak. One end of the suspension bridge was swept away

Photo by courtesy of *The Times*

Developments in Steam Reheating

Present Practice in British Power Stations

AT a meeting of the Institution of Mechanical Engineers on 7th March Messrs. F. H. S. Brown and J. W. H. Dore (Central Electricity Generating Board) discussed reheat practice in British power stations, as adopted in the present programme of the C.E.G.B. To illustrate the effect of reheating, data were tabulated for various unit ratings and steam conditions. Comparison was drawn between a hypothetical non-reheat set employing the same pressure (2,300 lb/sq in) and achieving the same efficiency as the 275 and 550 MW units projected. Steam temperature in the latter case was given as 1,050/1,050 deg F and in the former 1,225 deg F, the rate of heat input per MW to boiler being 7·77 million B.Th.U/hr in each case.

Advances in steam conditions had necessitated employment of some steam cooling of the furnace. With reheat, the steam-cooled surface was restricted to the superheater circuit, so as to limit pressure drop in the reheater system to 7½ per cent for the benefit of cycle efficiency and to secure, through the distribution of superheat surface and control of heat input, the requisite light load characteristics. These were typified by a steam temperature not more than 150 deg F below that of full load with a corresponding steam flow of 4 per cent during the starting period following a six-hour shutdown, with subsequent increase of output and superheat temperature to full rated value in 20 min. This should ensure that the steam temperature for the turbine at starting was not lower than that of the metal of the high-pressure cylinder.

To avoid risk of overheating of the exhaust end during sustained running at light loads, the reheater and its temperature control system was designed to reduce temperatures below full rated values, typically by 220 deg F at 25 per cent loading and 300 deg F at 10 per cent loading.

Furnace Arrangement

Furnaces for 120 MW units could be single undivided chambers, but either twin furnaces or divided walls would be necessary for 200 and 275 MW units. At present the width of superheater and reheater gas paths was limited to 35ft, and for 550 MW ratings two furnaces, each with division walls, were being considered. Limits of furnace heat release per sq ft of projected area (to avoid slagging of convection surfaces) had been gradually raised from 80,000 B.Th.U. to 95,000 B.Th.U. through the use of platen surfaces at the exit. While natural-circulation boilers could be designed for drum pressures of 2,800 lb/sq in, two-shift operation necessitated the greatest possible equality of circulation in all walls under starting conditions. Both superheater and reheater circuits were, therefore, being divided with parallel sections cross-connected at the various heat exchange stages.

The reheater was designed to operate at a much lower pressure than the rest of the boiler, but, for turbine governing, intercept valves were required to interrupt the steam flow to the turbine. The reheater, its piping and the whole high-pressure cylinder might, therefore, be exposed to the maximum boiler pressure unless it were fitted with safety valves capable of passing the whole rated steam flow of the boiler. Of these valves 20 per cent were at the reheater outlet and lifted first and the remainder at the inlet where the temperature was low.

For 200 and 275 MW 3,000 r.p.m. turbines with higher steam conditions and reheat, leaving losses should be no higher than for 60 MW units. This was being achieved by increasing the number of low-pressure turbine flows rather than by adopting the more expensive two-line (cross-compound) type of machine having a 1,500 r.p.m. low-pressure component. Both lines of the 550 MW units would run at 3,000 r.p.m.

Wetness at the exhaust was affected by the reheat pressure. The double-casing design usually employed for high initial pressures or temperatures did not readily lend itself to tapping for feed heating so the highest steam pressure for the purpose was that at the h.p. exhaust, which controlled the maximum feed temperature attainable. High reheat pressure reduced the specific volume of the steam, permitting the use of shorter blades at the intermediate pressure inlet. Both considerations resulted in a reheat pressure somewhat higher than the theoretical thermodynamic optimum.

Steam Control

The steam capacity of the reheat system introduced a reservoir of energy beyond the control of the turbine inlet valves. Loss of full load could give an acceleration of 15 per cent/sec, causing tripping speed to be reached in 0·7 sec while, following instantaneous closing of the h.p. steam control valves only, the steam in the system could raise the machine speed by 60 per cent; control of the inlet of reheated steam was therefore by two independent systems so arranged that failure of one would not result in loss of control of the machine.

While reheat reduced the economic condenser surface, which had now been brought down to 2/3ft²/kW, increases in ratings had entailed much new development in condenser design. Generally two shells with quadruple exhaust arrangements had been adopted, but consideration was now being given to taking four flows in one shell fabricated on site. Motor-driven rotary air-extraction pumps were now superseding air ejectors.

Up to and including 200 MW, two motor-driven feed pumps were supplied through a single switch, the motors having sufficient difference in starting torque characteristic to ensure the requisite lead of the first-stage pump on the final stage pump. Steam velocity had been raised from 130 ft/sec used for standard 60 MW sets to 170 ft/sec for the 200 MW sets and would reach 195 ft/sec for the 275 and 550 MW units. Current practice was to use only ferritic steels for high-pressure pipework. Satisfactory welding techniques for 2¼ per cent chromium—1 per cent molybdenum types had been established. The jointing of expensive austenitic steel of high creep strength for 1,050 deg F (the highest temperature yet adopted) introduced problems that were preferably avoided.

Other points in the paper related to the use of high steam conditions generally, apart from reheat, and to the influence of weight and size of sets. The authors' conclusion was that for the successful application of reheat, particularly at advanced pressures and temperatures, to two-shift service, the unit boiler-turbine concept was essential for control alone, reheat increasing the interdependence of conditions in various parts of the plant.

DOMESTIC ELECTRICAL EQUIPMENT

Kettles and Percolators

FOR the subject of this survey we have chosen electric kettles and coffee percolators, two items of domestic electrical equipment which demonstrate the efficiency and convenience of electricity in a way which is perhaps more apparent than in any other appliances. Both have the advantage that they can be plugged in almost anywhere where a suitable socket-outlet is available, their use not necessarily being confined to the kitchen. Apart from individual differences in styling, most manufacturers' models conform to a more or less standard pattern, the majority being either of aluminium or chromium-plated copper.

At one time an objection to the electric kettle was that it "took too long to boil." Speed of boiling, of course, depends upon the loading and the amount of water to be boiled, and present-day models with an average loading of 1,250 or 1,500 W compare very favourably with non-electric types. More manufacturers are now including models with the speedier 2 kW elements capable of boiling three pints of water in less than six minutes. The sizes most in demand are the three or four pint kettles, although six pint, and even a ten pint model (Tomlinson's "Baroness") are obtainable. G. & E. Equipment & Contracts, Ltd., have just marketed a non-metallic electric kettle, the "Pollyput." Revolutionary in design and construction, it is made of rigid polythene and has the advantage that it cannot be dented if dropped.

The range of coffee percolators available remains much the same as when these were last reviewed, and prices, on the whole, are unchanged. An exception is the Elga Products "Stardust," made of Staffordshire pottery, which has been reduced from £5 5s to £3 15s, with a corresponding reduction in purchase tax. This, we understand from the manufacturers, is due to its success in the export market, and the resultant benefits are being passed on to the home consumer.

KETTLES

Manufacturer	Name or Model	Capacity	Element Loading	Body	Handle	Special Features	Price (excl. tax)	Purchase Tax
BESCOL (ELECTRIC), LTD., 118, Parkfield Road, Saltley, Birmingham, 8.	"Elephant" 208	3 pint	1,500 W and 2,000 W	Chromium plated copper	Black Bakelite	Thermostatic safety device	£3 19 6 (1½ kW) £4 0 6 (2 kW)	£0 17 5 (1½ kW) £0 17 8 (2 kW)
	"Elephant" 214	3½ pint	1,500 W and 2,000 W	Polished aluminium	Black Bakelite	Thermostatic safety device	£2 18 6 (1½ kW) £2 19 6 (2 kW)	£0 12 10 (1½ kW) £0 13 0 (2 kW)
BEST PRODUCTS, LTD., Felix Works, Felixstowe Suffolk.	"Fanfare"	4 pint	1,500 W with cut-out	Chromium plated copper (a) and polished lacquered copper (b)	Black Bakelite	Organ toned musical alarm	£4 15 0 (a) £4 7 6 (b)	£1 0 10 (a) £0 19 2 (b)
	"Fanfare"	4 pint	1,500 W with cut-out	Chromium plated copper	Coloured handle and alarm cap	Organ toned musical alarm	£4 15 0	£1 0 10
	"Family"	3 pint	1,250 W and 1,500 W	Chromium plated copper	Bakelite (range of 5 colours)	Safety lid engagement	£3 15 10	£0 16 8
	"Family"	3 pint	1,250 W and 1,500 W	Enamelled copper (range of 4 colours)	Black Bakelite	Safety lid engagement	£3 15 10	£0 16 8
	"Jiffy"	2 pint	1,250 W	Chromium plated copper	Black Bakelite	Fast boiling, handle fixing prevents steam damage	£3 5 3	£0 14 3
	"Herald"	4 pint	1,500 W	Anodised aluminium (range of 5 colours)	Black Bakelite	Organ toned musical alarm	£2 17 0	£0 12 6
	"Standard"	3 pint	1,500 W	Polished aluminium	Metal strip, moulded grip	Block spout	£2 10 0	£0 11 0
BULPITT & SONS, LTD., Icknield Street, Birmingham, 18.	"Kitchen" 200	3½ pint	1,000 W	Brown vitreous enamel	Vitreous enamel	—	£2 13 11	£0 11 10
	"Kitchen" 205	3½ pint	1,500 W	Brown vitreous enamel	Vitreous enamel	—	£2 16 0	£0 12 3

Manufacturer	Name or Model	Capacity	Element Loading	Body	Handle	Special Features	Price (excl. tax)	Purchase Tax
BULPITT & SONS, LTD., Icknield Street, Birmingham, 18. (*continued*)	"Kitchen" C.200	3½ pint	1,000 W	Cream and green vitreous enamel	Vitreous enamel	—	£2 18 1	£0 12 8
	"Kitchen" C.205	3½ pint	1,500 W	Cream and green vitreous enamel	Vitreous enamel	—	£3 0 1	£0 13 2
	"Royal" CH.102	2 pint	850 W	Chromium plated copper	Heat insulated moulded plastic	Safety positioned knob and steam vents	£3 8 1	£0 14 11
	"Royal" CH.103	3 pint	1,000 W	Chromium plated copper	Heat insulated moulded plastic	Safety positioned knob and steam vents	£3 17 6	£0 17 0
	"Royal" CH.103A	3 pint	1,500 W	Chromium plated copper	Heat insulated moulded plastic	Safety positioned knob and steam vents	£3 19 7	£0 17 5
	"Royal" CH.105	5 pint	2,000 W	Chromium plated copper	Heat insulated moulded plastic	Safety positioned knob and steam vents	£4 12 6	£1 0 3
	"Popular" C.223	3 pint	1,000 W	Polished copper	Heat insulated moulded plastic	Safety positioned knob and steam vents	£3 6 5	£0 14 7
	"Popular" C.223A	3 pint	1,500 W	Polished copper	Heat insulated moulded plastic	Safety positioned knob and steam vents	£3 8 6	£0 15 0
	"Popular" C.226	6 pint	2,000 W	Polished copper	Heat insulated moulded plastic	Safety positioned knob and steam vents	£4 3 5	£0 18 4
	"Popular" CH.223	3 pint	1,000 W	Chromium plated copper	Heat insulated moulded plastic	Safety positioned knob and steam vents	£3 14 0	£0 16 3
	"Popular" CH.223A	3 pint	1,500 W	Chromium plated copper	Heat insulated moulded plastic	Safety positioned knob and steam vents	£3 16 1	£0 16 8
	"Popular" CH.224A	4 pint	1,500 W	Chromium plated copper	Heat insulated moulded plastic	Safety positioned knob and steam vents	£4 3 5	£0 18 4
	"Popular" CH.224B	4 pint	2,000 W	Chromium plated copper	Heat insulated moulded plastic	Safety positioned knob and steam vents	£4 5 11	£0 18 10

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1. *Bulpitt "Siren" whistling kettle*
2. *Best Products "Herald" alarm kettle*
3. *Bescol "Elephant" 208 kettle*
4. *Best Products "Family" three pint kettle*

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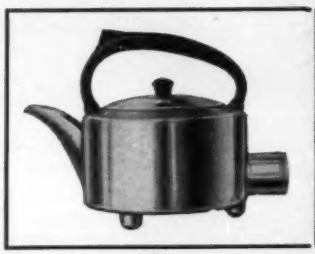

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Manufacturer	Name or Model	Capacity	Element Loading	Body	Handle	Special Features	Price (excl. tax)	Purchase Tax
BULPITT & SONS, LTD., Icknield Street, Birmingham, 18. (continued)	"Popular" CH.226	6 pint	2,000 W	Chromium plated copper	Heat insulated moulded plastic	Safety positioned knob and steam vents	£4 12 6	£1 0 3
	"Popular" A.223	3 pint	1,000 W	Aluminium	Heat insulated moulded plastic	Safety positioned knob and steam vents	£2 15 7	£0 12 2
	"Popular" A.223A	3 pint	1,500 W	Aluminium	Heat insulated moulded plastic	Safety positioned knob and steam vents	£2 17 7	£0 12 8
	"Popular" A.224A	4 pint	1,500 W	Aluminium	Heat insulated moulded plastic	Safety positioned knob and steam vents	£3 3 2	£0 13 10
	"Popular" A.224B	4 pint	2,000 W	Aluminium	Heat insulated moulded plastic	Safety positioned knob and steam vents	£3 5 7	£0 14 5
	"Popular" A.226	6 pint	2,000 W	Aluminium	Heat insulated moulded plastic	Safety positioned knob and steam vents	£3 8 11	£0 15 1
	Kettle and Saucepan CH.353	Kettle: 3 pint Inner Pan: 1½ pint	2-heat 1,000/125 W	Chromium plated copper. Aluminium pan	Heat insulated moulded plastic	Hinged kettle handle	£4 17 5	£1 1 4
	"Siren" CH.440	3 pint	2,000 W	Chromium plated copper	Heat insulated moulded plastic	Trigger action lid with built-in whistle	£4 11 1	£0 19 11
	"Swift" CH.303	3 pint	2,000 W	Chromium plated copper	Heat insulated moulded plastic	Fast boiling	£4 2 5	£0 18 1
BUNCHER & HASELER, LTD., Branston Street, Birmingham, 18.	877	6 pint	2,000 W	Polished aluminium	Black plastic	—	£3 12 0	£0 15 9
	"Golden Glimmer" 872	4 pint	1,500 W	Gold coloured anodised aluminium	Black plastic	—	£3 9 9	£0 15 3
CHALFONT ELECTRICAL PRODUCTS, LTD., Tyrrell Street, Leicester.	"Streamline"	4 pint	1,500 W	Polished aluminium	Moulded plastic	All welded construction	£2 17 6	£0 12 7
CO-OPERATIVE WHOLESALE SOCIETY, LTD., National Works, Hall Street, Dudley, Worcs.	"C.W.S. Dudley"	4 pint	1,250 W	Polished aluminium	Black Bakelite	—	£2 12 0	£0 11 5
	"C.W.S. Dudley"	4 pint	1,500 W	Polished aluminium	Black Bakelite	—	£2 14 0	£0 11 10
	"C.W.S. Dudley"	4 pint	1,250 W	Vitreous enamel	Vitreous enamel	—	£2 13 4	£0 11 8
DEPENDABLE PRODUCTS, LTD., Queensway, Team Valley Trading Estate, Gateshead, 11.	"Standard"	3½ pint	1,500 W	Aluminium (a) and Chromium (b)	Moulded plastic	—	£2 18 4 (a) £3 8 4 (b)	£0 12 10 (a) £0 15 0 (b)
	"Queensway"	3½ pint	1,500 W	Aluminium (a) and Chromium (b)	Moulded plastic	—	£3 5 3 (a) £3 15 1 (b)	£0 14 3 (a) £0 16 5 (b)
	"Royal"	3½ pint	1,500 W	Aluminium (a) Chromium (b)	Moulded plastic	—	£2 19 3 (a) £3 9 8½ (b)	£0 13 0 (a) £0 15 3½ (b)
EASIPOWER, LTD., 213-215, Gloucester Place, London, N.W.1.	A.K.S.	3½–4 pint	1,500 W	Polished aluminium	Steel reinforced plastic	Streamlined	£2 19 6	£0 13 0
	C.K.	3½–4 pint	1,500 W	Chromium plated copper	Steel reinforced plastic	Streamlined	£3 15 0	£0 16 6

Manufacturer	Name or Model	Capacity	Element Loading	Body	Handle	Special Features	Price (excl. tax)	Purchase Tax
ELGA PRODUCTS, LTD., Railway Place, Wimbledon, S.W.19.	"Conquest" A.5	3½ pint	1,000 W	Aluminium	Steel reinforced plastic	Large lid, fast pouring spout	£2 19 0	£0 13 0
	"Conquest" A.10	3½ pint	1,500 W	Aluminium	Steel reinforced plastic	Large lid, fast pouring spout	£3 1 0	£0 13 5
	"Conquest" A.12	3½ pint	2,000 W	Aluminium	Steel reinforced plastic	Large lid, fast pouring spout	£3 3 0	£0 13 10
	"Conquest" A.15	3½ pint	1,000 W	Chromium plated copper	Steel reinforced plastic	Large lid, fast pouring spout	£3 17 6	£0 17 0
	"Conquest" A.20	3½ pint	1,500 W	Chromium plated copper	Steel reinforced plastic	Large lid, fast pouring spout	£3 19 6	£0 17 5
	"Conquest" A.22	3½ pint	2,000 W	Chromium plated copper	Steel reinforced plastic	Large lid, fast pouring spout	£4 2 0	£0 18 0
	"Rainbow" A.11	3½ pint	1,500 W	Anodised aluminium, red, blue and green	Steel reinforced plastic	Large lid, fast pouring spout	£3 9 0	£0 15 2
ELTRON (LONDON), LTD., Strathmore Road, Croydon, Surrey.	"Combinax"	2 pint	500, 700 and 1,000 W	Polished aluminium	Black Bakelite	Removable element	£1 14 0 (500 W) £1 17 0 (700 W) £2 5 0 (1,000 W)	£0 7 8 (500 W) £0 8 4 (700 W) £0 10 1 (1,000 W)
	Car Kettle	1½ pint	—	Polished aluminium	Black Bakelite	For use on 12 V car battery	£1 15 0	£0 1 1
FALK, STADELMANN & CO., LTD., 91, Farringdon Road, London, E.C.1.	"Teatime" U.95697	4 pint	1,500 W	Polished aluminium	Heat resisting plastic	Large lid, fast pouring spout	£2 18 0	£0 12 9
GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, W.C.2.	D.5183	3 pint	2,000 W	Polished aluminium	Black Bakelite	Super-speed boiling, corrosion resistant, re-set safety device	£3 3 2	£0 13 10

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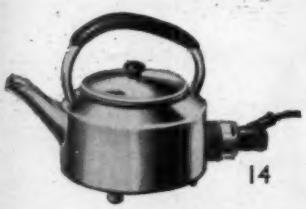
5. *G.E.C. D.5235A "Superspeed" kettle*
6. *Falk, Stadelmann "Teatime" U.95697 4 pint kettle*
7. *Bulpitt "Swift" lidless kettle*
8. *L. G. Hawkins L.G.H.707 3½ pint kettle*
9. *Easipower model C.K. kettle*
10. *C.W.S. "Dudley" 4 pint kettle*
11. *Chalfont "Streamline" kettle*
12. *Elga Products "Conquest" kettle*
13. *Buncher & Haseler "Golden Glimmer" 4 pint kettle*

Manufacturer	Name or Model	Capacity	Element Loading	Body	Handle	Special Features	Price (excl. tax)	Purchase Tax
GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, W.C.2. (continued)	D.5185	5 pint	2,000 W	Polished aluminium	Black Bakelite	Super-speed boiling corrosion resistant, re-set safety device	£3 11 4	£0 15 8
	D.5235	5 pint	2,000 W	Chromium plated copper	Black Bakelite	Super-speed boiling, re-set safety device	£4 19 8	£1 1 10
	D.5235A	3 pint	2,000 W	Chromium plated copper	Black Bakelite	Super-speed boiling, re-set safety device	£4 1 7	£0 17 11
G. & E. EQUIPMENT & CONTRACTS, LTD., Gore Road, New Milton, Hants.	"Pollyput"	4 pint	1,500 W	Rigid polythene, two-tone colours	Rigid polythene	Non-metallic, push-button lid control with whistle	£3 0 0	£0 13 0
L. G. HAWKINS & CO., LTD., 30-35, Drury Lane, London, W.C.2.	L.G.H.707	3½ pint	1,500 W	Polished aluminium	Steel with plastic grip	Automatic	£2 19 6	£0 13 0
	L.G.H.565	3½ pint	1,500 W	Polished aluminium	Steel with plastic grip	Automatic	£3 7 6	£0 14 10
	L.G.H.66	3½ pint	1,500 W	Chromium plated copper	Steel with plastic grip	Automatic	£4 9 6	£0 19 8
	L.G.H.202	2 pint	750 W	Polished aluminium	Metal	Non-automatic	£1 12 9	£0 7 2
	L.G.H.603	3 pint	1,000 W	Polished aluminium	Polished aluminium	Non-automatic	£1 17 6	£0 8 3
HOTPOINT ELECTRIC APPLIANCE CO., LTD., Crown House, Aldwych, W.C.2.	Premier "Pylon" 2939S, 2939 and 2939A	3 pint	2,000 W (2939S), 1,500 W (2939) and 1,000 W (2939A)	Chromium plated copper	Moulded plastic	Safety cut-out, "Torribar" elements	£3 19 6	£0 17 6
	Premier "Pylon" 2947S and 2947	4½ pint	2,000 W (2947S) and 1,500 W (2947)	Chromium plated copper	Moulded plastic	Safety cut-out, "Torribar" elements	£4 10 6	£0 19 11
	Premier "Pylon" 2833S, 2833 and 2833A	3 pint	2,000 W (2833S), 1,500 W (2833) and 1,000 W (2833A)	Polished aluminium	Moulded plastic	Safety cut-out, "Torribar" elements	£2 17 6	£0 12 8
	Premier "Pylon" 2837S, 2837 and 2837A	3 pint	2,000 W (2837S), 1,500 W (2837) and 1,000 W (2837A)	Polished copper, lacquered	Moulded plastic	Safety cut-out, "Torribar" elements	£3 19 6	£0 17 6
	Premier "Pylon" 2833GS, 2833G and 2833GA	3 pint	2,000 W (2833GS), 1,500 W (2833G) and 1,000 W (2833GA)	Anodised aluminium, satin gold	Moulded plastic	Safety cut-out, "Torribar" elements	£3 12 0	£0 15 10
LINCASS ELECTRIC, LTD., Guildford Street, Chertsey, Surrey.	950/951	4 pint	1,000 and 1,500 W	Chromium plated copper	Metal, plastic grip	—	£3 17 6 (1 kW) £3 19 6 (1½ kW)	£0 17 0 (1 kW) £0 17 5 (1½ kW)
	780/781	4 pint	1,000 and 1,500 W	Aluminium, coloured enamel finish	Metal, plastic grip	—	£3 2 6 (1 kW) £3 4 6 (1½ kW)	£0 13 8 (1 kW) £0 14 1 (1½ kW)
	770/771	4 pint	1,000 and 1,500 W	Polished aluminium	Metal, plastic grip	—	£2 15 6 (1 kW) £2 17 6 (1½ kW)	£0 12 1 (1 kW) £0 12 6 (1½ kW)
METWAY ELECTRICAL INDUSTRIES, LTD., Canning Street, Kemp Town, Brighton, 7.	"Miniway New" DA.389	2 pint	750 W (non-automatic)	Polished aluminium	Moulded plastic	—	£1 18 9	£0 8 5
	"Miniway De-Luxe" DA.429	2 pint	750 W	Polished aluminium	Moulded plastic	—	£2 2 9	£0 9 3
	"Boilaway" DA.559	4 pint	1,500 W	Polished aluminium	Moulded plastic	—	£2 15 9	£0 12 1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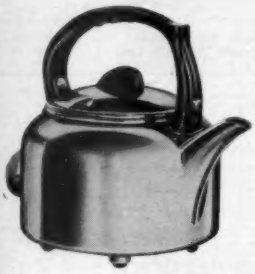
14. *Hotpoint "Premier" "Pylon" kettle*
15. *Midland Metal Spinning Co.'s "Towerbrite" aluminium kettle*
16. *Revo "Savoy" 3 pint kettle*
17. *Lincass model 950/951 4 pint kettle*
18. *Metway "Miniway De-Luxe" 2 pint kettle*
19. *Pifco model 1074 4 pint kettle*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Manufacturer	Name or Model	Capacity	Element Loading	Body	Handle	Special Features	Price (excl. tax)	Purchase Tax
METWAY ELECTRICAL INDUSTRIES, LTD., Canning Street, Kemp Town, Brighton, 7. *(continued)*	"Boilaway" DA.549	4 pint	1,000 W	Polished aluminium	Moulded plastic	—	£2 14 9	£0 11 10
	"Fastaway" DA.589	4 pint	1,800 W	Polished aluminium	Moulded plastic	—	£2 18 9	£0 12 9 *
	"Fastaway" DA.630	4 pint	2,000 W	Polished aluminium	Moulded plastic	—	£3 3 0	£0 13 8
	"Majaway" DA.699	6 pint	2,000 W	Polished aluminium	Moulded plastic	—	£3 9 9	£0 15 1
THE MIDLAND METAL SPINNING CO., LTD., Tower Works, Pelham Street, Wolverhampton.	"Towerbrite" 5035	3½ pint	1,500 W	Super pure aluminium	Bakelite	"Towerbrite" finish in silver, cut-out	£3 9 6	£0 15 3
	"Towerbrite" 5035G	3½ pint	1,500 W	Super pure aluminium	Bakelite	"Towerbrite" finish in gold, cut-out	£3 12 6	£0 15 11
	"Tower Brand"	3½ pint	1,500 W	Polished aluminium (a) Chromium plated copper (b)	Bakelite	—	£3 0 0 (a) £3 15 0 (b)	£0 13 2 (a) £0 16 5 (b)
PIFCO, LTD., Watling Street, Manchester, 4.	1074	4 pint	1,500 W	Golden anodised body, black lid	Plastic handle grip	Non-drip spout, plastic feet, cut-out	£3 9 9	£0 15 3
	1080	4 pint	1,500 W	Polished aluminium	Plastic handle grip	Plastic feet, cut-out	£2 17 0	£0 12 6
REVO ELECTRIC CO., LTD., Tipton, Staffs.	"Savoy"	3 pint	2,000 W	Chromium plated copper	Black Bakelite	Quick heating element	£3 19 6	£0 17 6
	"Cumberland"	3 pint	2,000 W	Polished aluminium	Red Bakelite	Quick heating element	£2 18 0	£0 12 9
RUSSELL HOBBS, LTD., 1, Bensham Lane, West Croydon, Surrey.	"Russell Hobbs" K.1.	3½ pint	1,750 W	Chromium plated copper	Moulded plastic	Vapour controlled, switches off when water boils	£4 18 9	£1 1 8
	"Russell Hobbs" K.1.Spa	3½ pint	1,750 W	Anodised aluminium, silver lustre, red, blue or green	Moulded plastic	Vapour controlled, switches off when water boils	£4 1 6	£0 17 11
ERNEST STEVENS, LTD., P.O. Box 2, Cradley Heath, Staffs.	"Judge" 671	3½ pint	1,500 W	Vitreous enamelled, yellow with black trim	Steel, enamelled black	Special shape, white coloured interior, cut-out	£4 4 0	£0 16 5

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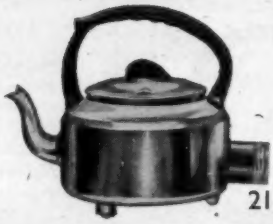

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20. *F. J. Tomlinson's "Baroness"*
21. *F. J. Tomlinson's "Marchioness"*
22. *Russell Hobbs vapour controlled kettle*

Manufacturer	Name or Model	Capacity	Element Loading	Body	Handle	Special Features	Price (excl. tax)	Purchase Tax
ERNEST STEVENS, LTD., P.O. Box 2, Cradley Heath, Staffs. *(continued)*	"Judge" 680	3½ pint	1,500 W	Vitreous enamelled, ivory with green trim	Steel, enamelled green	Special shape, white coloured interior, cut-out	£4 6 4	£0 16 10
F. J. TOMLINSON, LTD., Hall Carr Mill, Rawtenstall, Lancs.	"Countess"	4 pint	1,500 W or 2,000 W	Polished aluminium	Bakelite and metal	—	£2 9 11	£0 11 3
	"Marchioness"	3½ pint	1,500 W or 2,000 W	Polished aluminium (a), or anodised in red, blue or green (b)	Bakelite	—	£2 17 6 (a) £3 3 0 (b)	£0 12 11 (a) £0 14 3 (b)
	"Baroness"	10 pint	1,500 W	Polished aluminium	Bakelite and metal	—	£3 6 6	£0 15 0

COFFEE PERCOLATORS

Manufacturer	Name or Model	Capacity	Element Loading	Body	Handle	Special Features	Price (excl. tax)	Purchase Tax
BEST PRODUCTS, LTD., Felix Works, Felixstowe, Suffolk.	"Best" No. 2	2½ pint	500 W	Chromium on copper or pastel enamel shades	Black Bakelite	Automatic cut-out, indicator lights, pre-set percolation	£6 5 0 (chromium) £5 16 11 (enamel)	£1 7 6 (chromium) £1 5 7 (enamel)
BULPITT & SONS, LTD., St. Georges Works, Icknield Street, Birmingham 18.	"Mayfair" 480 S	1½ pint	400 W	"Swan-cromalin" plated	Black moulded plastic	Automatic re-set safety device	£5 5 0	£1 3 0
	"Dorchester" 450	2 pint	400 W	Polished aluminium	Black moulded plastic	Automatic re-set safety device	£3 12 7	£0 15 11
	"Belgrave" G 460	2 pint	450 W	Fine earthenware, green	Fine earthenware	Fully automatic	£4 18 5	£1 1 7
"CONA" COFFEE MACHINE CO., Felden Works, Railway Place, Wimbledon, S.W.19.	"De-Luxe" Table Model, I, II, IIA and III	½ to 2 pint	350 W	Chromium plated zinc stand, glass bowls	Wooden	Accessories include funnels and drainers	£4 11 9 to £5 9 9	£0 19 3 to £1 3 1
	"Rex"	1½ pint	350 W	Cast aluminium stand, glass bowls	Incorporated in body	On-off switch. Obtainable in range of enamelled colours	£8 19 9	£1 17 9
A. D. DAVIDSON ELECTRIC CO., 62-66, Granville Street, Birmingham, 1.	"Davey" C.601	1½ pint	400 W	Chromium on copper	Bakelite	Urn type fitted with tap	£4 14 6	£1 0 9
	"Davey" C.603	2½ pint	500 W	Chromium on copper	Bakelite	Urn type fitted with tap	£5 15 6	£1 5 4
	"Davey" C.606	4½ pint	950 W	Chromium on copper	Bakelite	Urn type fitted with tap	£8 7 6	£1 16 9
	"Davey" C.618	1½ pint	400 W	Chromium on copper	Bakelite	Jug type	£5 2 11	£1 2 7
ELGA PRODUCTS, LTD., Railway Place, Wimbledon, S.W.19.	"Stardust" A.36	1½ pint	450 W	Staffordshire pottery	As body	Automatic action. Matching coffee service extra	£3 15 0 £1 10 0 (coffee service)	£0 15 0 £0 6 0 (coffee service)
GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, London, W.C.2.	D.5373	1½ pint	400 W	Chromium on copper	Black Bakelite	High and low heat control, thermal protection device	£6 10 0	£1 8 6

Manufacturer	Name or Model	Capacity	Element Loading	Body	Handle	Special Features	Price (excl. tax)	Purchase Tax
HOTPOINT ELECTRIC APPLIANCE CO., LTD., Crown House, Aldwych, W.C.2.	Hotpoint 614 PI	8 cups	400 W	Chromium plated copper	Black moulded plastic	Safety cut-out, glass top	£6 17 9	£1 10 3
	Premier 652	8 cups	400 W	Chromium plated copper	Black moulded plastic	Safety cut-out, glass top	£6 17 9	£1 10 3
LINCASS ELECTRIC, LTD., Guildford Street, Chertsey, Surrey.	651	1½ pint	500 W	Chromium plated, black anodised	Black Bakelite	Earthed connector	£4 4 0	£0 18 4
	654	1½ pint	500 W	Chromium plated, black anodised	Black Bakelite	Switched connector	£4 7 6	£0 19 0
RUSSELL HOBBS, LTD., 1, Bensham Lane, Croydon, Surrey.	"Russell Hobbs"	1 to 2 pint	600 W	Ceramic, primrose, dove grey and green, three contemporary flower decorations. Also maroon and "Empire" finish	Ceramic	Time control selector. Companion sugar basin and jug extra	£4 4 0 (a.c.) £4 7 6 (a.c./d.c.) £0 11 8 (matching set)	£0 18 5 (a.c.) £0 19 3 (a.c./d.c.) £0 2 6 (matching set)
S.L.R. ELECTRIC, LTD., Welbeck Road, South Harrow, Middlesex.	"Phœnix" CB.6	1½ pint	500 W	Heat-resisting glass	Black Bakelite	Can be used independently on electric hot-plates	£3 0 0	£0 13 6
F. J. TOMLINSON, LTD., Hall Carr Mill, Rawtenstall, Rossendale, Lancs.	"Handy"	2 pint	450 W	Chromium on copper	Veneered wood	Glass top	£4 4 0	£0 18 11

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23. *Hotpoint 614 PI percolator*
24. *Bulpitt "Dorchester" coffee percolator*
25. *G.E.C. D.5373 1½ pint coffee percolator*
26. *Best Products "Best No. 2" coffee percolator*
27. *Lincass model 651 percolator*
28. *Elga Products "Stardust" coffee set*
29. *F. J. Tomlinson's "Handy" percolator*
30. *S.L.R. "Phœnix" model CB6*
31. *A. D. Davidson "Davey" C.601 urn type percolator*
32. *Russell Hobbs coffee pot*

Financial Section

STOCKS and SHARES

IN the first part of March the industrial markets of the Stock Exchange put on their best performance for several months past. Factors assisting in the revival included the continuing improvement in the gold reserve figures, a slightly more confident lead from Wall Street, and a general feeling that the heavy fall in share prices since last autumn had gone at least a long way towards discounting the uncertainties still to be faced. There did not seem to be a great deal of steam behind the movement, but public interest was said to be broadening a little and it took only a moderate amount of buying to show that supplies of good stock are anything but plentiful. The A.E.I. statement on the 1957 results helped to keep electrical shares to the fore of the market advance.

A.E.I. Results

The £1 shares of Associated Electrical Industries moved up to above 50s on satisfaction with the preliminary statement of the financial results for 1957, and the maintenance of the dividend at a total of 15 per cent, which puts the shares on a yield basis just below 6 per cent. From the figures it seems that in the second half of the year there was a continuance of the improvement reported half-way through the period. Trading profits of the group, at just on £10 million, come out some £300,000 below the 1956 level, but the balance is taken after charging practically £800,000 more for depreciation; and with a lower tax provision this time the net surplus, at £4¼ million, is slightly higher than before. This appears to cover about one and a half times over the net amount of the dividend distribution.

New Projects

In considering the A.E.I. results for 1957, and while awaiting details in the full report, the market assumed that the group continued to contend with a contraction of profit margins in most of its branches, so that credit for the satisfactory outcome would be due mainly to larger turnover. In this connection reference was made to the review by Lord Chandos at last year's annual meeting, when he spoke of the number of new factories then in course of building. Whereas these new projects involved heavy expenses of a non-productive nature in their initial stages, they were expected to begin their contribution to revenues during the latter part of 1957. An unusually large influx of orders in the early part of the year was also mentioned by the chairman in the last report.

Better Prices

Shares of many of the big electrical and nuclear power groups figured prominently in the industrial market's recovery movement. English Electric were again in the lead, adding 3s 9d to the substantial improvements already achieved since the company's annual results appeared last month, and reach-

Price Changes in

Company or Board	Nom. Value	Middle price 10th Mar.	Week's Rise or Fall	Dividend Previous	Dividend Last	Yield %	1957 Highest	1957 Lowest
Gilt-edged Stocks						£ s d		
Brit. Elec. 1968/73	100	73		3	3	4 2 3	80	70
Brit. Elec. 1974/77	100	70½	+½	3	3	4 5 0	78½	66
Brit. Elec. 1976/79	100	74½		3½	3½	4 14 0	81½	70
Brit. Elec. 1974/79	100	83½		4½	4½	5 1 9	92½	79½
Overseas Electric Supply								
Calcutta Elec.	£1	15/6		6†	6·8†	8 15 6†	19/-	15/-
East African Power	£1	19/-	+6d	7	7½	7 18 0	21/-	19/-
Nigerian Elec.	£1	15/6		10	10	12 18 0	18/6	16/6
Perak Hydro-Elec.	£1	15/-		10	12½	16 13 3	18/-	13/3
Electrical Shares								
Aberdare Cables	5/-	10/9	+1/-	17½	17½	8 2 9	12/-	9/9
Aerialite	1/-	5/9	+3d	48	51½	9 0 0	6/9	4/9
Allen, W. H.	£1	33/6		10	10	5 19 6	47/3	33/6
Anglo-Portuguese Tel.	£1	20/3		8	8	7 18 0	27/6	20/6
Aron Elec. Ord.	£1	54/-		15	15	5 11 0	60/-	53/6
Assoc. Elec. Ord.	£1	50/6	+1/9	15	15	5 18 9	73/-	48/9
Automatic Tel. & El.	£1	60/6		15	17	5 12 6	75/-	54/6
Babcock & Wilcox	£1	45/9	+2/9	15	13‡	5 13 6	82/6	54/9
Bakelite	10/-	17/-	−2/6	16	15	8 16 6	24/6	20/9
Baldwin, H. J.	2/-	3/6		20	20	11 8 6	5/-	3/9
Berry's Electric	5/-	6/-		—	10	8 6 9	6/6	5/6
British Aluminium	£1	45/6	+1/3	12	12	5 5 6	71/3	38/9
Brit. Elec. Traction: Def. Ord. "A"	5/-	22/-		22½	25	5 13 9	25/-	17/-
B.I. Callender's	£1	39/9		12½	12½	6 5 9	55/-	39/6
B.I. Callender's 6% Pref. ...	£1	20/-		6	6	6 0 0	21/9	19/-
British Tabulating	£1	40/-	+6d	9	10	5 0 0	56/3	37/6
British Thermostat	5/-	23/9	+1/3	25	25	5 5 3	27/6	21/3
British Vac. Cleaner	5/-	5/-		15	10	10 0 0	8/-	5/-
Brook Motors	10/-	35/-		25	25	7 2 9	37/6	30/-
Bulgin, A. F.	1/-	5/6	+6d	40	45	8 2 9	5/6	4/-
Burco Dean	5/-	7/9	−3d	20	22½	9 13 6*	9/4	5/10
Cable & Wireless: Ord.	5/-	10/3	+6d	10	10	—	12/6	9/6
4% Loan	100	93½		4	4	4 5 6	92½	89
Chloride El. Storage "A" ...	£1	60/-		17½	17½	5 17 9	68/9	55/9
Clarke Chapman	£1	115/-	−5/-	27½	27½	4 15 9	9	5½
Cole, E. K....	5/-	16/9	+1/-	17½	17½	5 4 6	23/6	16/6
Cossor, A. C.	5/-	4/9	+3d	Nil	2½	2 12 9	7/3	5/-
Crabtree	10/-	25/3		20	20	7 18 6	26/-	23/3
Crompton Parkinson Ord. ...	5/-	9/-	+6d	16	16	5 18 6*	11/9	9/3
De La Rue	5/-	24/3	+1/3	30	35	7 4 3	24/9	16/3
Decca "A"	4/-	25/-	+2/6	43½	43½	7 0 0	32/3	22/-
Desoutter	5/-	13/9		30	32½	5 18 3*	17/9	13/9
Dewhurst	2/-	7/-		16½	20	5 14 3	7/9	5/9
Dictograph Tel.	2/-	5/3		20	20*	7 12 6	6/3	5/3
Dubilier Condenser	1/-	3/3		30	30	—	5/3	3/-
Duport	5/-	8/3		25	25	7 11 6*	10/6	8/6
E.M.I.	10/-	30/-	+1/3	15	15	5 0 0	36/-	23/9
Electrical Components	5/-	7/6		25	12½*	8 6 9	8/-	6/6
Elec. Construction	£1	21/3		8½	8½	8 0 0	27/6	21/9
Elliott-Automation	5/-	13/-	+1/-	—	10‡	3 17 0	12/6	10/3
Enfield Cable Ord.	£1	11/-		Nil	Nil	Nil	21/6	12/3
English Electric	£1	51/3	+3/9	14	14	5 9 3	65/-	47/6
English Electric 3½% Pref. ...	£1	12/3		3½	3½	6 2 6	14/3	11/3
Ericsson Tel.	5/-	18/6	+6d	22†	12†*	3 4 9†	25/-	17/-
Ever Ready	5/-	14/9	+3d	35	37½	6 7 0*	20/-	14/-
Falk Stadelmann	£1	37/6	+6d	17½	17½	9 6 9	40/6	35/-

The above quotations are based upon middle prices in the Stock Exchange Daily Official List.
* After scrip issue. † Free of income tax. ‡ Dividend indicated.

ing 51s 3d. Parsons, Reyrolle, and Babcock & Wilcox gained about half-a-crown apiece, and Crompton Parkinson moved up from 8s 6d to 9s. Still under the influence of good results reported earlier, Taylor Tunnicliff, Hoover, Westinghouse, and Mather & Platt all made further good advances. Johnson & Phillips, Hackbridge Holdings and other cable shares were helped by the Aberdare Cables report. A. F. Bulgin rose 6d to 5s 6d after the company's announcement of increases in earnings and the dividend. There were other good features in the radio group, including Decca, Pye, E.M.I. and Ekco, while Elliott-Automation were much in favour.

Electrical Investments

Company or Board	Nom. Value	Middle price 10th Mar.	Week's Rise or Fall	Dividend Previous	Dividend Last	Yield % £ s d	1957 Highest	1957 Lowest
Electrical Shares—continued								
G.E.C. Ord.	£1	30/9	+9d	14	12½	—	58/9	37/6
G.E.C. 6½% Pref.	£1	20/6		6½	6½	6 6 9	23/6	19/6
General Cables	5/-	11/3	−9d	30	24	10 13 3	15/6	11/6
Greenwood & Batley	£1	47/3		17½	17½	7 8 3	51/3	45/3
Hackbridge Holdings	5/-	8/9	+6d	30	20	11 8 6	21/9	11/3
Hackbridge & Hewittic	5/-	10/-		23	20	10 0 0	16/-	10/-
Head Wrightson	5/-	17/3		20	22½	—	24/3	16/6
Heatrae	2/-	4/3		15	15	7 1 3	4/9	4/-
Henley's	10/-	12/6		11½	11½	9 4 0	17/-	11/-
Holophane	5/-	13/-		30	37½	8 13 3*	15/9	10/3
Hoover	5/-	36/6	+3/-	50	50	6 17 0	44/-	24/9
I.C.I.	£1	39/3	+1/3	10	10	5 2 0	46/6	36/3
Intl. Combustion	5/-	23/6		22½	25	5 6 6	30/-	19/3
Johnson & Phillips	£1	16/3	+9d	15	10	12 6 3	34/6	18/9
Lancashire Dynamo	£1	31/3		11	11	7 0 9	45/9	33/6
Laurence, Scott	5/-	12/9		15	15	5 17 9	19/9	13/9
Lister, R. A.	£1	24/3	+1/-	10	10	8 5 0	33/9	23/3
London Elec. Wire	£1	40/-		12½	12½	6 5 0	53/9	40/9
Lucas, J.	£1	32/-	+2/-	7½	7½	4 13 9	36/6	27/6
Marconi Marine	£1	30/-		10	10	6 13 3	37/-	30/-
Marryat & Scott	2/-	10/3	−3d	30	35	6 16 6	13/-	8/-
Mather & Platt	£1	48/9	+3/3	15	15	6 3 0	63/9	47/-
Metal Industries	£1	26/6	+1/6	Nil	9	6 15 9	30/-	20/3
Midland Elec. Mfg.	£1	47/6	+1/3	12½	12½	5 5 3	52/6	45/-
Morphy-Richards	4/-	15/-		50	20*	5 6 9	20/-	11/6
Murex	£1	54/3		20	20	7 7 6	79/6	50/3
Newman Ind.	2/-	2/9		10	10	7 5 6	2/11	2/1
Oldham & Son	1/-	2/6		17½	17½	7 0 0	3/-	2/3
Parnall (Yate)	5/-	6/-		12	12	10 0 0	8/9	5/9
Parsons, C. A.	£1	46/6	+2/-	8½	7½*‡	—	71/3	45/-
Plessey	10/-	58/9	+2/6	30	30	5 2 3	86/3	60/-
Pye "A" Deferred	5/-	12/-	+1/3	12½	12½	5 4 3	20/-	12/-
Reyrolle	£1	76/3	+2/6	16½	17½	4 11 9	110/-	72/-
Rheostatic	4/-	6/6	−1/3	12½	12½	7 13 9	10/-	7/-
Richardsons Westgarth	10/-	14/-		16½	16½	5 19 0*	20/-	13/6
Scottish Cables	4/-	12/3		27½	27½	8 19 6	19/3	13/3
Simon-Carves	5/-	22/6	−1/-	28½	20*	4 9 0	36/3	23/9
Smith (England), S.	4/-	7/9	+3d	17½	20	5 3 3*	8/-	6/3
Southern Areas	£1	10/3		7½	7½	14 12 9	20/-	11/3
Strand Elec.	5/-	5/3		15	15	14 5 9	8/-	5/9
Sturtevant	5/-	18/-		15†	15†	4 3 3†	27/-	17/9
Sun Elec.	£1	47/6		25	25	10 10 6	47/6	42/-
Switchgear & Cowans	5/-	10/-	+3d	25	25	—	15/6	9/6
Taylor Tunnicliff	5/-	13/9	+1/-	15	17½	6 7 6	13/9	11/9
T.C.C.	10/-	37/6		25	25	6 13 3	41/3	35/-
T.C. & M.	£1	22/-	+1/-	8½	8½	7 14 6	31/-	23/6
Telephone Mfg.	5/-	4/6	−3d	10	10	11 2 3	8/-	5/3
Telephone Rentals	5/-	10/6		12½	12½	5 19 0	12/6	9/6
Thompson (John)	5/-	25/-	+1/-	25	25	5 0 0	37/-	23/6
Thorn Elec.	5/-	20/9		15	17½	4 4 3	26/3	16/3
Thornycroft	£1	23/3	+2/-	12½	12½	10 15 0	37/6	21/3
Tube Investments	£1	52/-	+2/9	13½	15	5 15 6	70/-	51/3
Vactric	5/-	14/6		17½	25	8 12 6	23/9	12/9
Veritys	5/-	5/3		12½	12½	11 18 3	9/3	6/9
Walsall Conduits	4/-	11/9		20	20	6 16 3	15/-	11/-
Ward & Goldstone	5/-	24/-		35	40	4 3 3*	29/-	18/6
Watford	2/-	5/6		25	25	9 1 9	6/9	5/9
Westinghouse	£1	36/3	+1/3	18	10*	5 10 3	41/3	28/9
West, Allen	5/-	9/6		15	15	—	13/6	9/6
Wolf Electric	5/-	7/9	−3d	20	20	6 9 0*	13/9	8/9

Ericsson Dividend

The final dividend of 10 per cent (tax-free) is payable on Ericsson Telephones' capital doubled by the capital issue of last October, and represents an increase of 1 per cent on the final distribution of 18 per cent (including 6 per cent as bonus) paid a year ago. With the interim dividend the total for the latest year is equivalent to 12 per cent net. After easing a little to 18s 6d, the 5s shares show a yield of 3¼ per cent net, or about 5¾ per cent subject to tax, on the new dividend rate. After taxation and a heavier charge for depreciation, the net profit is £130,000 below the previous surplus at £584,000; but after payment of the dividends the company is able to add £300,000 to the general reserve. Although £1 million of the latter was capitalised in last year's scrip issue, this fund is now level again with the £2 million ordinary stock.

Morphy-Richards

The 4s shares of Morphy-Richards have been steadily maintained for some weeks at a price of around 15s. There has been little change in the quotation since the publication of the interim report covering the first half of the year ending next June. In brief, this reported a substantial increase in sales which, however, was little more than sufficient to maintain group profits at their previous level. Sales of the parent company topped the £3 million mark for the first time in any six months' period. The disproportionately small change in the level of profits is being closely considered by the board, and they regard trading conditions as too uncertain to permit a forecast for the remainder of the year. For 1956–57 the company paid a dividend of 20 per cent, and on that rate the shares show a yield of nearly 5½ per cent.

Aberdare Cables Results

Aberdare Cables (Holdings) 5s shares were marked up sharply from 9s 9d to 10s 6d on the strength of the company's preliminary announcement of earnings during the year ended last October. Whereas expectations had been prepared to see profits affected by smaller profit margins and the slump in copper prices (the last balance sheet showed stocks and work in progress at over £1¼ million) the surplus of £263,000 proves in fact to have improved a little on the previous year's result, despite a larger tax provision. It provides twofold cover for the ordinary dividend, which is being maintained for the fourth successive year at a total of 17½ per cent, on which basis the shares show a yield of rather more than 8 per cent.

REPORTS and DIVIDENDS

International Combustion (Holdings), Ltd.—The main figures in the accounts for the year ended 30th September last were given in our issue of 21st February. The report and accounts now issued include the annual review by Sir James Young (chairman), in the course of which he says that export deliveries during the year were substantially increased, as were those associated with the various specialities of the company in the general industrial field. The output of the main works at Derby again showed an increase, notwithstanding many production difficulties arising from a changing pattern of the major items of boiler plant. The light engineering shop was completed in the summer of 1957, and is now fully manned, as is also the plate shop extension and the laboratory extension referred to in the last review. Having regard to the future obligations of International Combustion, Ltd., as a member of Atomic Power Constructions, Ltd., for the manufacture of pressure vessels, heat exchangers, etc., for nuclear power station plant, the board gave serious consideration to the provision of a heavy plate and drum shop at Derby, equally suitable for the production of vessels and components for the chemical industry and allied fields. This project, which represented a considerable change in the previous manufacturing policy of the group, was authorised by the board at the beginning of the last financial year, and when complete will represent a capital outlay of approximately £1,000,000. Orders have been placed for buildings, plant and services and it is hoped that initial operation of this production unit will commence in January, 1959.

The value of orders on hand at the end of September last showed an increase of approximately £1,000,000 as compared with the total for the previous year. Since the close of the year, the Export Company, acting in partnership with the British Thomson-Houston Co., has been successful in negotiating a large, complete power station contract for the City of Buenos Aires, and this will involve the group in the supply of steam generation units, coal handling plant and other equipment to a total value of approximately £10 million.

The Central Electricity Generating Board has recently awarded a contract to International Combustion, Ltd., for the 550 MW unit boiler for Thorpe Marsh. This coal-fired unit has nearly three times the steam capacity of any previous individual unit ordered by the Board. During the financial year and in the past few months substantial orders for coal handling plant for home and overseas generating stations have also been obtained, and this department of the group is now very actively employed. The progress made by the Gaseous and Liquid Fuel Department has also continued at a satisfactory level and they have now successfully commissioned their first major power station installation to burn fuel oil in place of pulverised coal.

The Midland Electric Manufacturing Co., Ltd.—In his annual statement covering 1957, Mr. A. Wynn (chairman and joint managing director) says that the current year is the golden jubilee year of the company, and it is pleasing to report, therefore, a record volume of sales and trading profit. During the year under review the company completed the acquisition of freehold premises for new branch offices and depots in London and Manchester. Regarding the future, a great part of their output is sold in export markets, in several of which severe economic and currency difficulties are now being experienced, whilst the Government's measures to control inflation are likely to have some depressing effect on the industries upon which they depend for their home business. For these reasons they are already noticing some decline in the volume of current orders.

Mr. Wynn refers to the fact that the present year will conclude his thirty-fifth year of service with the company, of which he has been managing director for the past eighteen years and chairman since 1954. He indicates his desire to shortly relinquish his executive duties and says that the necessary changes in the composition of the board will be announced in the near future.

Bruce Peebles & Co., Ltd.—The financial results for 1957 were given in our last issue. In his review of the year, Mr. S. A. Gaskell, who recently succeeded Sir William Y. Darling as chairman of the company, pays tribute to the valuable work of Sir William as chairman, and says that he is glad that he has agreed to remain on the board. Although the year started with a full order book, the outlook generally was uncertain, but the year's progress gives reasonable grounds for satisfaction. Orders received during the year, as well as output, exceeded the £3 million mark, being the highest ever recorded; the value of orders in hand is in excess of the total at the end of 1956. These orders include three 90,000 kVA transformers for the Electricity Trust of South Australia. Since the end of the year the order book has been further enlarged by an order from the C.E.G.B. for two 18,000 kW and one 12,000 kW turbo-alternators for Rheidol and Dinas hydro-electric stations in Wales. The work of the electronics research laboratory, which was formally opened by Mr. Thomas Johnston last September, has fulfilled expectations. During the year they dispatched the largest transformer ever built in their shops, as well as the largest generator. These units are now operating in Scotland. They have contributed largely to the establishment of nuclear power plants whenever the opportunity has presented itself.

Associated Electrical Industries, Ltd.—The preliminary statement for 1957 shows a trading profit of £9,988,476, as compared with £10,307,614 for 1956, and after providing £5,484,401 for United Kingdom taxation the net profit is £4,504,075 (against £4,459,713). To this is added £571,380 set aside for taxation in previous years no longer required, and after deducting £95,762, outside shareholders' interest in net profit of subsidiaries, and £1,012,086 retained by subsidiaries, the balance available for appropriation by the holding company is £3,967,607 (£4,081,715). General reserve receives £1,000,000 and it is proposed to pay a final dividend on the ordinary stock of 7½ per cent, maintaining the distribution for the year at 15 per cent on increased capital. The balance carried forward is £748,571 (against £819,577 brought in).

Bylock Electric, Ltd.—The report and accounts for the year to 31st July last, now issued, confirm the figures given in our issue of 21st February. In his circulated statement, Mr. C. A. Mathes (chairman) says that in spite of still greater competition in the domestic appliance field and the ever rising tide of higher prices, both of labour and material, it has been possible to achieve a record turnover, and at the same time a substantially increased net profit. To date, whilst they have been met by rising costs, it has been possible to maintain turnover comparable to the year now under review.

Hoover, Ltd.—The main figures in the accounts for the year 1957 were given in our last issue. In his review of the year, Mr. H. W. Hoover (chairman) says that in spite of the difficulties caused by the drive against inflation and the measures to restrict expansion of credit, and economic difficulties in some overseas countries, Hoover, Ltd., had a successful year. The turnover of the British companies increased by 13 per cent and the net profit increased from £2,790,000 to £3,757,000. There were reductions in many material prices during the year, notably in copper and rubber, but these reductions were more than offset by the higher cost of steel and higher wages, resulting in an increase of overall costs, which was most marked during the latter half of the year.

In the export markets they have made great efforts to increase their business and have met with reasonable success. Their dollar earnings have again been satisfactory, totalling

$3,084,722. They are still responsible for around 70 per cent of the total United Kingdom exports of vacuum cleaners and washing machines. In their overall organisation they now employ 16,500 people, of whom nearly 5,000 are employed in the subsidiary companies overseas. The dominant feature of the year has been the introduction of the new "Hoovermatic" washing machine and spin-dryer combination, the initial reception of which has been encouraging.

Sales of cleaners have continued at a satisfactory level. There is still room for considerable development of the market, although the sale of these products to new users will not be so marked as that for washing machines. There is, however, a large replacement market which is, and will continue to be, of growing importance in the overall total. It is now some three years since the introduction of steam irons to the British market, and ownership has been rising steadily. In the United States, dry irons represent only 15 per cent of the market, 85 per cent being a combination steam and dry iron, and this pattern is likely to be reproduced in Great Britain within the foreseeable future.

With regard to the export market, although shipments from the United Kingdom show little change over those of 1956, the total export sales, including the turnover of the manufacturing units overseas, show an increase of 4 per cent. The policy of establishing manufacturing units in countries with restrictive import conditions but a good potential market has resulted in a reduction of exports from the United Kingdom, although the sales in these countries have been considerably increased.

Mr. Hoover concludes his review with references to the activities of the overseas subsidiaries.

The Rheostatic Co., Ltd., reports a trading profit for the year to 30th September last of £379,330, as compared with £421,816 for the previous year and a net profit of £110,960 (against £148,175), before taking into account the profits tax relative to dividends paid or recommended. General reserve receives £25,000 and it is proposed to maintain the ordinary dividend for the year at 12½ per cent, with a final payment of 7½ per cent. The balance carried forward is £6,384 (against £6,107 brought in).

Taylor, Tunnicliff (Electrical Industries), Ltd.—The accounts for 1957 were reviewed in our last issue. In his circulated statement, to be presented at the annual meeting on 26th March, Mr. P. Cooper (chairman) says that the past year has not been without its difficulties. The effects of a recession in the demand for die-pressed products, bringing with it keener competition and lower profit margins, has fortunately been offset by a substantial increase in high voltage insulator production. This has been achieved as a result of the expansion schemes which have been carried out during the past few years, enabling the company to meet the increased demand and attain a record output in its history. Additional developments are now being envisaged and special attention is being directed to the further modernisation of existing plant in their effort to maintain, as far as possible, present selling prices against ever-rising costs. In this connection, substantial sums have already been authorised this year for expenditure and further commitments are under consideration.

The British Oxygen Co., Ltd.—In the course of his review of the group's activities during the year ended 30th September last, Mr. J. S. Hutchison (chairman) says that Quasi-Arc, Ltd., with improved earnings, has maintained its position in the fields of electrodes and electric welding equipment. New electrodes, such as "Ferromax" and processes such as "Fusarc/CO_2," introduced last year, have won a quick place in the market. Demand continues strongly in automatic welding in applications for nuclear plant construction and other modern engineering practice. Recent installations of very large gantry-mounted equipments for deck welding and similar uses have aroused much interest. The outlook in electric welding remains favourable despite a reduction in export trade caused by increasing local manufacture and by keen price competition overseas.

Ericsson Telephones, Ltd.—The trading profits for 1957 amount to £1,764,011, as compared with £1,838,672 for the preceding year. After meeting all charges, including £666,753 for taxation, the net balance is £584,359 (against £715,054). General reserve receives £300,000 and it is proposed to pay a final ordinary dividend of 10 per cent, making 14 per cent, tax free, for the year. The final dividend is paid on doubled capital. The total dividend for 1956 on smaller capital was 22 per cent. The balance carried forward is £379,919 (against £343,682 brought in). The directors state that output last year was a record, but profit margins were lower, mainly due to higher labour costs.

A. F. Bulgin & Co., Ltd., report trading profits for the year ended 31st January last of £165,936, as compared with £146,448 for 1956-57, and after providing £93,414 for taxation the net balance is £72,522 (against £64,350). A sum of £5,000 is placed to general reserve, and it is proposed to pay a dividend for the year of 45 per cent (against 40 per cent). The balance carried forward is £83,189 (against £54,479 brought in).

The Dowty Group, Ltd., has announced an interim dividend of 5 per cent tax free (against 4 per cent). The half-yearly statement shows an estimated profit, before tax, of approximately £475,000 for the six months to 30th September last, and the directors state that they believe the final result for the year to 31st March next will show an increase of some 25 per cent over last year's figures.

Thos. W. Ward, Ltd., has declared an interim dividend of 5 per cent (unchanged).

E. K. Cole, Ltd., are paying an interim dividend of 7½ per cent (unchanged).

Aberdare Cables (Holdings), Ltd., reports that after providing £346,212 for taxation the net profit for the year to 31st October last amounted to £262,583, as compared with £253,113 for 1955-56. It is proposed to pay a final dividend of 10 per cent, maintaining the distribution for the year at 17½ per cent, and to carry forward £695,587 (against £563,782 brought in).

New Companies

Paxtons Electrical & Engineering, Ltd.—Registered 20th February. Capital £100. Electricians, mechanical engineers, etc. Directors: E. T. Rowsell, Barbara Rowsell and Ruth E. Rowsell. Regd. office: 70, Wimpole Street, W.1.

Walker Widmayer, Ltd.—Registered 20th February. Capital £5,000. Electrical, electronic and mechanical engineers, etc. Directors: N. K. Walker, Don F. Widmayer, R. W. G. Braithwaite and H. G. Jones. Regd. office: 3, St. Helens Place, Bishopsgate, E.C.3.

Transelectronics, Ltd.—Registered 19th February. Capital £100. Manufacturers, sellers, importers and exporters of and dealers in all kinds of electrical, electronic and scientific apparatus and equipment, etc. Directors: F. Beacroft, P. W. Faulkner and W. F. Cross. Regd. office: 56, Vicarage Lane, Ilford, Essex.

Cathora (Northern), Ltd.—Registered 24th February. Capital £100. Electrical engineers and contractors, etc. Directors: R. R. Bell, Doris I. Bell, C. D. Hodson and L. J. Partridge. Regd. office: 174, High Street, Hounslow.

Holliday (Northern), Ltd.—Registered 24th February. Capital £1,000. Electricians, electrical engineers, etc. Directors: Kathleen Holliday and M. J. Holliday. Solicitors: Bulcraig & Davis, Amberley House, Norfolk Street, W.C.2.

G. A. Hubbard, Ltd.—Registered 24th February. Capital £1,000. Electrical, auto-electrical, radio and television engineers, etc. Directors: G. A. Hubbard, Mrs. Marjorie C. Hubbard, P. A. W. Hubbard and Nellie B. L. Hubbard. Regd. office: Market Place, Saxmundham, Suffolk.

F. G. Ilbury (Transformer Services), Ltd.—Registered 24th February. Capital £3,000. Electrical engineers and contractors, etc. Directors: F. G. Ilbury and C. A. Gooch. Regd. office: Wheatsheaf Yard, High Street, Harlington, Hayes, Middx.

Edicron, Ltd.—Registered 25th February. Capital £1,000. Importers, exporters, distributors and manufacturers of and dealers in electronic, radio, radar and television and scientific instruments and accessories, etc. Edith Cruh is the first director. Regd. office: 166, Piccadilly, W.1.

C. Spencer Electric, Ltd.—Registered 17th February. Capital £1,000. Manufacturers of and dealers in electrical fittings and electrical goods, radio and television receivers, components, etc. Directors: C. M. Spencer and Margaret J. Spencer. Regd. office: 149-151, Pentonville Road, N.1.

Liquidation

Philpot Brothers (Electrical Engineers), Ltd., 35, Upper Tooting Road, London, S.W.17.—Winding up voluntarily. Liquidator, Mr. G. Bowyer, Ridgway House, 41-42, King William Street, London, E.C.4, appointed 26th February.

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (3s 6d each including postage) will be obtainable after 19th March from the Patent Office, 25, Southampton Buildings, London, W.C.2

1954

2197. British Thomson-Houston Co., Ltd.—Electrical computing apparatus. 18th January, 1955. (792173.)

3167. Electric & Musical Industries, Ltd.—Apparatus embodying electronic pick-up tubes. 20th January, 1955. (792099.)

7869. Mastini, D.—Automatic device for answering phone calls and recording phone communications. 18th March, 1954. (792146.)

17220. Philips Electrical Industries, Ltd.—Circuit arrangements for automatically terminating X-ray exposures. 11th June, 1954. (Addition to 751786.) (792051.)

19443. Igranic Electric Co., Ltd.—Methods of and apparatus for regulating the voltage of electric generators. 2nd July, 1954. (792226.)

23273. Parnall (Yate), Ltd.—Washing machines. 9th November, 1955. (792128.)

23626. Egyesült Izzolampa es Villa-Mossagi R. T.—Cathode-ray tubes for use in television receivers. 13th August, 1954. (792046.)

28373. British Thomson-Houston Co., Ltd.—Electrical sweep generators employing semi-conductor devices. 13th September, 1955. (791959.)

32263. General Electric Co., Ltd.—Electric switching arrangements. 8th February, 1956. (792111.)

35449. Ilford, Ltd.—Electronic relay devices. 6th December, 1955. (Addition to 667296.) (791961.)

1955

763. Philips Electrical Industries, Ltd.—Electric capacitors. 10th January, 1955. (792130.)

3065. Watson & Sons (Electro-Medical), Ltd.—Control of a.c. supply circuits. 2nd February, 1956. (792112.)

3839. Parmeko, Ltd.—Electric transformers. 8th February, 1956. (791985.)

4787. Pye, Ltd.—Electrostatic loudspeakers. 17th February, 1956. (792131.)

BOOKS RECOMMENDED BY

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5571. Claude Paz et Visseaux.—Method of sealing a tungsten part in hard glass. 24th February, 1955. (792132.)

6337. General Electric Co.—Mass spectrometers. 3rd March, 1955. (792042.)

8299. Pitometer Log Corporation.—Radar signal simulator. 22nd March, 1955. (792119.)

10388. Marrison & Catherall, Ltd.—Centralising means for electronic devices making use of a focused electron beam. 10th April, 1956. (792002.)

10921. Compagnie Générale de Télégraphie sans Fil.—Electronic storage tubes. 15th April, 1955. (792103.)

12548. Ever Ready Co. (Great Britain), Ltd., and Gibbins, A. E.—Dry cells. 14th March, 1956. (792152.)

13949. Carr Fastener Co., Ltd.—Electrical switches incorporating warning lamps. 10th May, 1956. (792153.)

15129. General Electric Co.—Circuits employing semi-conductor devices. 25th May, 1955. (792120.)

16578. Pirelli-General Cable Works, Ltd.—Metal sheathed electric cables. 20th April, 1956. (792228.)

17644. General Electric Co., Ltd., and Cook, K. G.—Thyratron circuits. 18th June, 1956. (792015.)

17835. Hoover, Ltd.—Washing machines. 5th June, 1956. (791966.)

22015. Naamlooze Vennootschap Philips' Gloeilampenfabrieken. — X-ray fluorescent spectrometry. 29th July, 1955. (792048.)

23046. Pye, Ltd.—Tuning device for electrical tuned circuits. 10th August, 1956. (792203.)

24322. Lucas (Industries), Ltd., J.—Bushes for dynamo-electric machine and other commutators. 16th August, 1956. (792005.)

24504. Sperry Rand Corporation.—Automatic frequency control systems for radio navigation systems. 25th August, 1955. (792229.)

24510. General Electric Co., Ltd.—Preparation of single crystals of silicon. 3rd August, 1956. (792006.)

24815. Electric Storage Battery Co.—Electric batteries. 30th August, 1955. (792204.)

26004. Westinghouse Air Brake Co.—Automatic circuit selector. 12th September, 1955. (792231.)

26842. General Motors Corporation.—Electric switches operable by rotary and axial movement of a control member. 20th September, 1955. (792062.)

27192. Rajewsky, B.—High power X-ray tube. 23rd September, 1955. (792019.)

27902. Standard Telephones & Cables, Ltd.—Magnetic focusing of electron beams. 30th September, 1955. (792020.)

28968. British Insulated Callender's Cables, Ltd.—Means for jointing wires. 11th October, 1956. (792008.)

29535. Siemens & Halske Akt.-Ges.—Radio transmitting systems. 17th October, 1955. (792067.)

33064. Standard Telephones & Cables, Ltd.—Tuning indicator tube. 18th November, 1955. (792021.)

33900. Feifel, E., and Prochazka, R.—Electrostatic dust collectors. 25th November, 1955. (792068.)

36642. Marconi Instruments, Ltd.—Wave meters. 16th August, 1956. (792022.)

1956

1273. Stempel-Hermetik Ges.—Electric motor driven compressors for hermetically sealed small refrigerating units. 13th January, 1956. (792139.)

1846. Philips Electrical Industries, Ltd.—Tuning devices, more especially but not exclusively for use in television receivers. 19th January, 1956. (792140.)

5790. Amalgamated Wireless (Australasia), Ltd.—Hum eliminating circuits for audio frequency amplifiers. 24th February, 1956. (792025.)

9024. Aktiebolaget Tudor.—Electric accumulator cells. 22nd March, 1956. (792143.)

10800. Columbus McKinnon Chain Corporation.—Method of and apparatus for electric resistance welding. 9th April, 1956. (792030.)

12852. General Electric Co.—Mass spectrometers. 26th April, 1956. (792043.)

21931/3. Stichting Reactor Centrum Nederland.—Nuclear reactors. 16th July, 1956. (792113/4.)

32929. Physikalische Studienges. Düsseldorf.—Fuel element for nuclear reactors. 29th October, 1956. (792170.)

33246. General Electric Co.—Methods of assembling dynamo-electric machines. 31st October, 1956. (792221.)

33728. Commissariat a l'Energie Atomique.—Heat removal systems for nuclear reactors. 5th November, 1956. (792171.)

39688. General Electric Co.—Mass spectrometers. 3rd March, 1955. (Divided out of 792042.) (792044.)

TRADE MARKS

APPLICATIONS have been made for the registration of the following trade marks. Objections may be entered up to 26th March:

HAWKINS. No. 747,635. Class 9. Foot warmers, flat irons and kettles, all being electric; and electrical apparatus incorporating automatic mechanisms for use in making hot beverages.—L. G. Hawkins & Co., Ltd., 30-35, Drury Lane, Kingsway, London, W.C.2.

POWER PILL. No. 760,785. Class 9. Thermostats. — Robertshaw-Fulton Controls Co., Greensburg, Penn., U.S.A. Address for service, c/o Frank B. Dehn & Co., Kingsway House, 103, Kingsway, London, W.C.2.

CUBIGEAR. No. 769,089. Class 9. Electrical switchgear; electrical apparatus and instruments for use in controlling the operation of machines by means of electric current control; switchboards (complete); and signalling, measuring and checking (supervision) apparatus and instruments.—D.C. Engineering Co., Ltd., Lambrook House, Wincanton, Som.

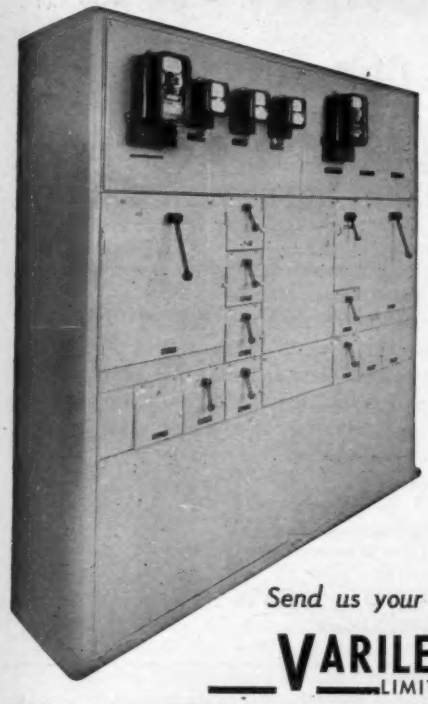
PYEWAY. No. 770,487. Class 9. Radar, echo-sounding, nautical, signalling, navigational, radio, television, telegraphic, telephonic and telecommunication apparatus and instruments; scientific, electrical, acoustical and electronic apparatus and instruments; electric batteries, accumulators, gramophones, gramophone pick-ups, microphones, amplifiers, loudspeakers, sound records, electric oscillation generators, germanium diodes, transistors and electric semi-conducting materials; and parts and fittings for all the above goods; but not including domestic electrical appliances or any goods of the same description.—Pye, Ltd., Radio Works, St. Andrews Road, Cambridge.

CARCO. No. 769,666. Class 9. Separators for electric batteries.—Carr & Co. (Paper), Ltd., Carco Works, Shirley, Birmingham.

ALFERON. No. 771,713. Class 9. Electrical resistances made of metal alloys.—British Driver-Harris, Ltd., Gaythorn Mill, Albion Street, Manchester, 15.

SONETTE. No. 772,001. Class 10. Electromedical acoustic apparatus, hearing aids for the deaf, medical instruments and apparatus for detecting and estimating the degree of deafness, and parts.—Amplivox, Ltd., 2, Bentinck Street, Manchester Square, London, W.1.

Cubicle Switchboards



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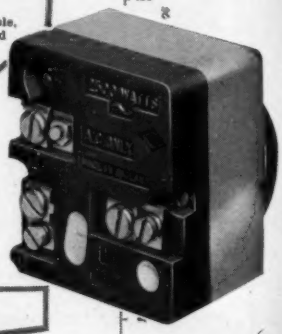

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NEXT WEEK'S EVENTS

Organisers of electrical functions are advised to make use of the "Electrical Review" clearing house, Room 221, Dorset House, Stamford Street, London, S.E.1, to ascertain that proposed dates for their functions do not clash with others already arranged.

Monday, 17th March

BIRMINGHAM.—Grand Hotel, 6.15 p.m. Birmingham Electric Club. Annual general meeting followed by "European Hydro-Electric Plant in Manufacture and Operation," by P. R. Maddock.

BRISTOL.—Royal Hotel, 7 p.m. I.E.S. Bath and Bristol Centre. "Decorative Lighting—A Designer's Approach," by D. W. Durrant.

CARDIFF.—At the South Wales Institute of Engineers, 6 p.m. I.E.E. Western Supply Group. "My Visit to the U.S.A.", by J. S. Lombard.

CHESTER.—Town Hall, 6.30 p.m. I.E.E. Mersey and North Wales and North Western Centres. Joint meeting. "Recent Uses of Ultrasonics in Investigating the Characteristics of Materials," by Dr. J. Lamb.

IPSWICH.—Electric House, 7.15 p.m. Ipswich and District Electrical Association. "Electronics—The Approach to Industry," by A. G. Barton.

LONDON.—Northampton Polytechnic, St. John Street, E.C.1, 6.15 p.m. Institute of Metal Finishing, London Branch. "Anodes," by H. Cann.

NEWCASTLE-UPON-TYNE.—King's College, 6.15 p.m. I.E.E. North Eastern Radio and Measurements Group "Some Transistor Input Stages for High-Gain D.C. Amplifiers" and "A Transistor High-Gain Chopper-Type D.C. Amplifier," by Dr. G. B. B. Chaplin and A. R. Owens.

NORWICH.—Assembly House, 7.30 p.m. I.E.E. East Anglian Sub-Centre. "The Human Operator in Closed-Loop Control Systems," by Prof. K. A. Hayes.

Tuesday, 18th March

BELFAST.—Union Hotel, 7 p.m. Institution of Electronics, Northern Division. Film show on electronic topics.

BRADFORD.—Technical College, 7 p.m. I.E.E. North Midland Centre and Utilisation Group. Joint meeting. "Circuit-Breaking and Power System Problems," by C. H. W. Lackey and A. T. Crawford.

CHELMSFORD.—Public Library, 6.30 p.m. I.E.E. London Graduate and Student Section district meeting. Film evening.

COVENTRY.—Coventry Electricity Sports and Social Club, Merrick Lodge, St. Nicholas Street. Coventry Electric Club. Annual film show.

EDINBURGH.—Carlton Hotel, North Bridge, 7 p.m. I.E.E. South-East Scotland Sub-Centre. "The B.B.C. Sound Broadcasting Service on Very-High Frequencies," by E. W. Hayes and H. Page.

GLASGOW.—39, Elmbank Crescent, 7 p.m. I.E.E. South-West Scotland Sub-Centre. "The Potentialities of Railway Electrification at the Standard Frequency," by E. L. E. Wheatcroft and H. H. C. Barton.

GLOUCESTER.—Fleece Hotel, Westgate Street, 6.30 p.m. I.E.S. Gloucester and Cheltenham Centre. "The New Approach to Interior Lighting Design," by J. M. Waldram.

LIVERPOOL.—Liverpool Passenger Transport Office, 24, Hatton Garden, 6 p.m. I.E.S. Liverpool Centre. "Light as an Effective Aid to Architecture," by R. H. Ruff, R. V. Mills and H. E. Bellchambers.

LONDON.—At the Institution of Electrical Engineers, Savoy Place, W.C.2, 6.30 p.m. A.S.E.E. London National Lecture. "Industrial Closed-Circuit Television," by R. E. Blythe.

Piccadilly Hotel, W.1, 12.30 for 1 p.m. Electric Light Fittings Association. Annual luncheon.

London School of Hygiene and Tropical Medicine, Keppel Street, W.C.1, 6.30 p.m. British Institution of Radio Engineers, London Branch. Discussion on the Technical Committee's Report, "Recommended Method of Expressing Electronic Measuring Instrument Characteristics: 1—A.M. or F.M. Signal Generators."

Great George Street, Westminster, S.W.1, 5.30 p.m. Institution of Civil Engineers. James Forrest Lecture, by Sir John Cockcroft.

47, Belgrave Square, S.W.1, 5.30 p.m. Institute of Physics, Electronics Group. "Microwave Ferrites," by L. A. Thomas.

MANCHESTER.—Engineers' Club, Albert Square, 6.15 p.m. I.E.E. North-Western Utilisation Group. "The Use of Steel Tank Mercury-Arc Invertors for Generating Medium Frequencies for Induction Heating," by D. L. Smart and J. J. L. Weaver.

College of Science and Technology, 7 p.m. Institution of Chemical Engineers, North Western Branch. "Heat Transfer in Relation to Nuclear Engineering," by W. B. Hall.

NEWCASTLE-UPON-TYNE.—Crown Hotel, Clayton Street West, 7.30 p.m. A.S.E.E. Tyneside Branch. "Films in Colour on Continental Travel," by A. W. Franklin.

READING.—S.E.B. Offices, Market Place. E.I.B.A. Berks., Bucks. and Oxon Branch. Annual general meeting.

ST. LEONARDS-ON-SEA.—Uplands Lecture Theatre, Archery Road, 7 p.m. Ministry of Works, Hastings Branch. "Nuclear Energy and some Associated Problems," by W. L. Day.

SWANSEA.—University College, Singleton Park, 6.30 p.m. Institute of Metals, South Wales Section. Annual general meeting, followed by short papers.

WREXHAM.—Lecture Hall, Technical College, Ministry of Works, Wrexham Branch. "Powered Hand Tools," by A. F. Coare.

Wednesday, 19th March

BRIGHTON.—Technical College, 6.30 p.m. I.E.E. Southern Centre. "British Columbia-Vancouver Island 138 kV Submarine Power Cable," by Dr. T. Ingledow, R. M. Fairfield, E. L. Davey, K. S. Brazier and J. N. Gibson.

CARDIFF.—Park Hotel. Incorporated Plant Engineers, South Wales Branch. Annual general meeting followed by annual dinner.

COLWYN BAY.—Co-operative Society Hall, Sea View Road, 7 p.m. Ministry of Works, Colwyn Bay Branch. "Powered Hand Tools," by A. F. Coare.

LEICESTER.—Bell Hotel, 7 p.m. Incorporated Plant Engineers, Leicester Branch. Annual general meeting.

LONDON.—Savoy Place, W.C.2, 5.30 p.m. I.E.E. Radio and Telecommunication Section. "Efficiency and Reciprocity in Pulse-Amplitude Modulation: Part I—Principles," by K. W. Cattermole. "Part II—Testing and Applications," by J. C. Price. "Transistor Pulse Generators for Time—Division Multiplex," by K. W. Cattermole.

I.E.E. London Graduate and Student Section, 6 p.m. Visit to University of London Observatory, Mill Hill Park, N.W.7.

John Adam Street, Adelphi, W.C.2, 2.30 p.m. Royal Society of Arts. "Industrial Power of the Future," by Sir Christopher Hinton.

MANCHESTER.—College of Science and Technology, 6.45 p.m. I.E.E. North Western Radio and Telecommunication Group. "Domestic High-Fidelity Reproduction," by J. Moir.

MIDDLESBROUGH.—Cleveland Scientific and Technical Institution, Corporation Road, 6.30 p.m. I.E.S. Tees-Side Group. "The Lighting Laboratory," by G. Mainwaring.

NOTTINGHAM.—County Hotel, Theatre Square, 7 p.m. Incorporated Plant Engineers, East Midlands Branch. Annual general meeting.

ROCHESTER.—King's Head Hotel, 7 p.m. Incorporated Plant Engineers, Kent Branch. "High Pressure Steam Generation," by O. S. Denham.

SHEFFIELD.—Grand Hotel. Combustion Engineering Association, Northern Region. 10.30 a.m. "Brains Trust" on "Space Heating and Insulation." 2.15 p.m. "Boiler Inefficiency."

STAFFORD.—Technical College, 7 p.m. I.E.E. North Staffordshire Sub-Centre and Graduate and Student Section. Joint meeting. Three short papers.

Thursday, 20th March

BIRMINGHAM.—College of Technology, Gosta Green, 6.30 p.m. Institute of Metals, Birmingham Section. Annual general meeting and chairman's address.

BLACKBURN.—Golden Lion Hotel, 7.30 p.m. Incorporated Plant Engineers, Blackburn Branch. Annual general meeting.

CHELMSFORD.—Hoffmann's Social Hall, 7.30 p.m. Chelmsford Engineering Society. "Digital Computers and their Practical Use in Engineering," by Dr. M. V. Wilkes.

EDINBURGH.—George Hotel, 7 for 7.30 p.m. I.E.E. Scottish Centre. Annual dinner.

IRELAND.—I.E.E. Irish Branch. "The Design and Acoustical Treatment of Broadcasting Stations with particular reference to the new Radio Eireann Cork Studio," by E. J. Slowey and P. A. Kneafsey.

LONDON.—Savoy Place, W.C.2, 5.30 p.m. Institution of Electrical Engineers. "Storage and Manipulation of Information in the Brain," by Dr. R. L. Beurle.

I.E.E. London Graduate and Student Section. Day visit to B.P. Refinery (Kent), Ltd., Isle of Grain.

College of Preceptors, Bloomsbury Square, W.C.1, 7 p.m. Incorporated Plant Engineers, London Branch. "The Construction of a Nuclear Power Station."

A.S.E.E. North West London Branch. Evening visit to Mount Pleasant Parcels Office.

Caxton Hall, Westminster, S.W.1, 2.30 p.m. Diesel Engineers' and Users' Association. "Governing of Diesel Engines," by R. A. Fuller.

MANCHESTER.—Demonstration Theatre, N.W. Electricity Board, Town Hall, 6 p.m. I.E.S. Manchester Centre. "An Architect's Views on Lighting," by J. R. Sheridan.

PETERBOROUGH.—White Lion Hotel, Church Street, 7.30 p.m. Incorporated Plant Engineers, Peterborough Branch. Annual general meeting.

PLYMOUTH.—South Western Electricity Board Showroom, New George Street, 3 p.m. I.E.E. South-Western Sub-Centre. "Cathodic Protection," by L. B. Hobgen, K. A. Spencer and P. W. Heselgrave.

PORT SUNLIGHT.—Hulme Hall, 7 p.m. I.E.E. Mersey and North Wales Centre. Dinner-dance.

Friday, 21st March

BIRMINGHAM.—Imperial Hotel, Temple Street, 7.30 p.m. Incorporated Plant Engineers, Birmingham Branch. Annual general meeting.

LONDON.—Café Royal, 7 for 7.30 p.m. I.E.E. Radio and Measurements Sections. Joint dinner-dance.

Connaught Rooms, Great Queen Street, W.C.2, 7 for 7.30 p.m. Batti-Wallahs' Society. Ladies' night.

NEWCASTLE-UPON-TYNE.—Old Assembly Rooms, 7 for 7.30 p.m. I.E.E. North-Eastern Centre. Annual dinner and dance.

Institute of Fuel Luncheon

The annual luncheon of the Institute of Fuel will be held on 24th April at the Connaught Rooms, London. Applications for tickets (25s each) should be made by 8th April to the secretary of the Institute, 18, Devonshire Street, Portland Place, London, W.1.

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

CONTRACTS OPEN

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses

Australia.—Electricity Commission of New South Wales, Sydney. 24th March. Goods and passenger elevators for Tallawarra power station. (E.S.B. 5752/58. Ten/31270.)* Control, protection and metering boards for substation. (E.S.B. 5751/58. Ten/31219.)*

Director of Stores and Contracts, P.M.G.'s Department, Melbourne. 29th April. Cord type switchboards and relay sets. (E.S.B. 5790/58. Ten/31288.)*

Belgium.—Antwerp City Council. 10th April. Four electrically driven pumps and accessories. (E.S.B. 4889/58. Ten/31193.)*

Blackpool.—Corporation. 14th April. Street lighting equipment. (See this issue.)

Burma.—Burma Purchase Board, Rangoon. 21st March. Lead wire. (E.S.B. 5880/58. Ten/31269.)* 25th March. Electrical equipment including house service meters, cut-outs, 100 W transformers and porcelain connectors. (E.S.B. 6472/58. Ten/31411.)* Electric refrigerators. (E.S.B. 6471/58. Ten/31395.)*

Canada.—Manitoba Hydro-Electric Board, Winnipeg. 2nd April. 138 kV air blast circuit-breakers. (E.S.B. 5852/58. Ten/31262.)*

Consett (Durham).—U.D.C. Electric floor heating and lighting in an extension to the Council depot at Villa Real. Surveyor, Council Offices, Medomsley Road, Consett.

Dundee.—Corporation. 31st March. Trunk road lighting equipment. (See this issue.)

Greece. — Public Power Corporation, Athens. 5th April. Diesel electric generating sets. (E.S.B. 5686/58. Ten/31266.)*

Hereford.—City Council. 14th April. Street lighting equipment. (See this issue.)

India.—Singareni Collieries Co., Ltd., Andhra Pradesh. 15th April. Electrically driven winding engine and equipment. (E.S.B. 5842/58. Ten/31250.)*

Bombay Electric Supply and Transport Undertaking. 17th April. Seven 10,000 kVA transformers. (E.S.B. 5976/58. Ten/31325.)* 22 kV and 6·6 kV switchgear and accessories. (E.S.B. 6001/58. Ten/31324.)* 6·6 kV and 1,100 V and 22 kV cables and accessories. (E.S.B. 5975/58 and 6002/58. Ten/31326-7.)*

Iran.—Plan Organisation, Tehran. 5th May. Electrification of the town of Susangerd. (E.S.B. 5998/58. Ten/31319.)*

Iraq.—Central Foreign Purchase Committee, Ministry of Finance. 15th April. Electric lift for Mirjan Hospital. (E.S.B. 5961/58. Ten/31309.)*

Development Board and Ministry of Development, Baghdad. 2nd June. Steel towers and erection of power lines for the electrification of the Central Euphrates zone. (E.S.B. 5964/58. Ten/31315.)*

Korea.—Government Office of Supply, Seoul. 28th March. Electrically driven pumps with accessories. (E.S.B. 5953/58. I.C.A. Ten/31296.)*

Leicestershire.—County Council. 1st April. Switchboard for internal telephone system at County Offices. (See this issue.)

London.—India Store Department. 14th April. Microphone and receiver headgear assemblies No. 10. (See this issue.)

* Specifications may be inspected at the Export Services Branch, Board of Trade, Lacon House, Theobald's Road, London, W.C.1 (Chancery 4411; extension 769).

New Zealand.—G.P.O., Wellington. 11th April. Capacitors. (E.S.B. 5899/58. Ten/31287.)*

Philippines.—National Power Corporation, Manila. 1st April. Tie-up, switching structures and load-end substation for the Talomo No. 3 hydro-electric project. (E.S.B. 5841/58. Ten/31265.)*

Rhodesia and Nyasaland.—Tender Board, Causeway. 11th April. X-ray plant. (E.S.B. 5892-3/58. Ten/31292-3.)*

South Africa.—Union Tender and Supplies Board, Pretoria. 20th March. Jointing sleeves. (E.S.B. 5631/58. Ten/31226.)* Cable suspension clamps and light wire clamps. (E.S.B. 5911/58. Ten/31270.)*

Transvaal Provincial Administration, Pretoria. 21st March. One 25 kVA diesel driven generating set. (E.S.B. 6396/58. Ten/31390.)*

Stores Department, South African Railways, Johannesburg. 2nd April. Two 500 kVA indoor transformers. (E.S.B. 5788/58. Ten/31263.)*

Sudan.—Ministry of Works, Stores Section. 20th March. Electric lamps. (E.S.B. 6021/58. Ten/31343.)*

Sudan Gezira Board, Supplies Department, Barakat. 31st March. Seventy electric motors and starters. (E.S.B. 6105/58. Ten/31344.)*

Sunderland.—Corporation. Street lighting, St. Lawrence Street area. Borough engineer, 27, Fawcett Street, Sunderland.

United States.—Bureau of Reclamation, Denver. 20th March. Power circuit-breakers. (E.S.B. 5825/58. Ten/31255.)*

West Lancashire.—R.D.C. 21st March. Street lighting equipment. (See this issue.)

Wiltshire.—County Council. Electrical installation in new primary school. (See this issue.)

WORK IN PROSPECT

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors

Aldershot.—Flats (56) and five shops, North Town redevelopment; borough engineer, Town Hall.

Ashford (Kent).—Dwellings (87), Beaver Green Farm estate; W. E. Cox, Ltd., builders, Unity Street, Sheerness.

Bangor.—Nursing home and extensions to St. David's Hospital; Welsh Regional Hospital Board, 5/7, Museum Place, Cardiff.

Barking.—Works extensions; G. B. Educational Equipment, Ltd., Fresh Wharf, Highbridge Road.

Bexhill-on-Sea.—Block of flats, Park Road and West Parade; Kenneth G. Higgs, architect, 7, Wilton Road.

Flats (20), Hillside Road; Knight Bros., Ltd., builders, 19, Bristol Gardens, Brighton.

Coalville.—Aged persons' hostel; county architect, 123, London Road, Leicester.

Grammar school, Castle Rock site (£140,000); county architect, Leicester.

Doncaster.—Wilby Carr Secondary Modern School; borough architect.

Dudley.—Houses (61), Lower Gornal; Eaton Manor Estates, 5, Norfolk Road, Holly Hall.

Eccles.—Flats (36), Cawdor Street/Barlow Street; F. Bradley, architect to T.C., Penny Bank Chambers, 4, Wood Street, Bolton.

Edinburgh.—Houses (27), Broomhouse Crescent and Calder Road; A. Steele, city architect, City Chambers, High Street.

Hounslow.—Offices and flats, Lampton Road Island site; Tersons, Ltd., builders, 4, Dollis Park, London, N.3.

Lanarkshire.—Development of the Bridgend and Moodisburn areas, providing for over 900 houses, shops, community centre, school, etc.; D. G. Bannerman, county architect, 34, Albert Street, Motherwell.

London.—Seven-storey building, Lincoln's Inn Fields, W.C.2, to form headquarters for the College of General Practitioners; Trehearne & Norman Preston & Partners, architects, 83, Kingsway, Holborn, W.C.2.

Fire station, Lindsell Street, S.E.10 (£100,000); Hubert Bennett, Architects' Department, County Hall, Westminster Bridge, S.E.1.

Three eleven-storey blocks of flats, Fulham (£649,562); Tersons, Ltd., builders, 4, Dollis Park, N.3.

Mansfield.—Office extensions; Kirk Bros., Ltd., builders, 112, George Street.

Newhaven.—Factory; Pure Lemon Juice Co., Ltd., 130, Oval Road, Croydon.

North Riding.—Sawmills, etc., at Carlton-in-Cleveland, for Penney Brothers, Ltd., Skinner Street, Stockton.

Primary school at Nunthorpe (£45,000); T. Pearson & Son, builders, Borough Road West, Middlesbrough.

Northumberland.—Proposed private housing developments at Killingworth and Westerhope; J. T. Bell & Sons, builders and contractors, Market Street, Newcastle-on-Tyne.

Rushden.—Houses (46), Rose Avenue and Short Stocks; clerk, Urban Council Buildings, Rushden, Northants.

Salisbury.—Permanent coach station, car park site (£53,710); H. Rackham, city surveyor, Council House, Bourne Hill.

Smethwick.—Further new buildings for Chance Technical College; Walter W. Atkinson & Partners, architects, 4, Raymond Buildings, Gray's Inn, London, W.C.1.

Southampton.—Science laboratories for Bitterne Park School; M. D. Little, architect, 17, College Place.

Southwick.—Flats (36), Fishergate No. 1 scheme; U.D.C. surveyor, Town Hall, Southwick, Sussex.

Stalybridge.—New works and offices; Gripfast Engineering Co., Ltd., Ridge Hill Lane.

Stockton-on-Tees. — Works extensions (50,000 sq ft); South Durham Steel & Iron Co., Ltd.

Stokesley (Yorks).—Additions to Stokesley Grammar School (Stage 2) for the North Riding E.C. (£56,000); F. Shepherd & Son, builders, Blue Bridge Lane, York.

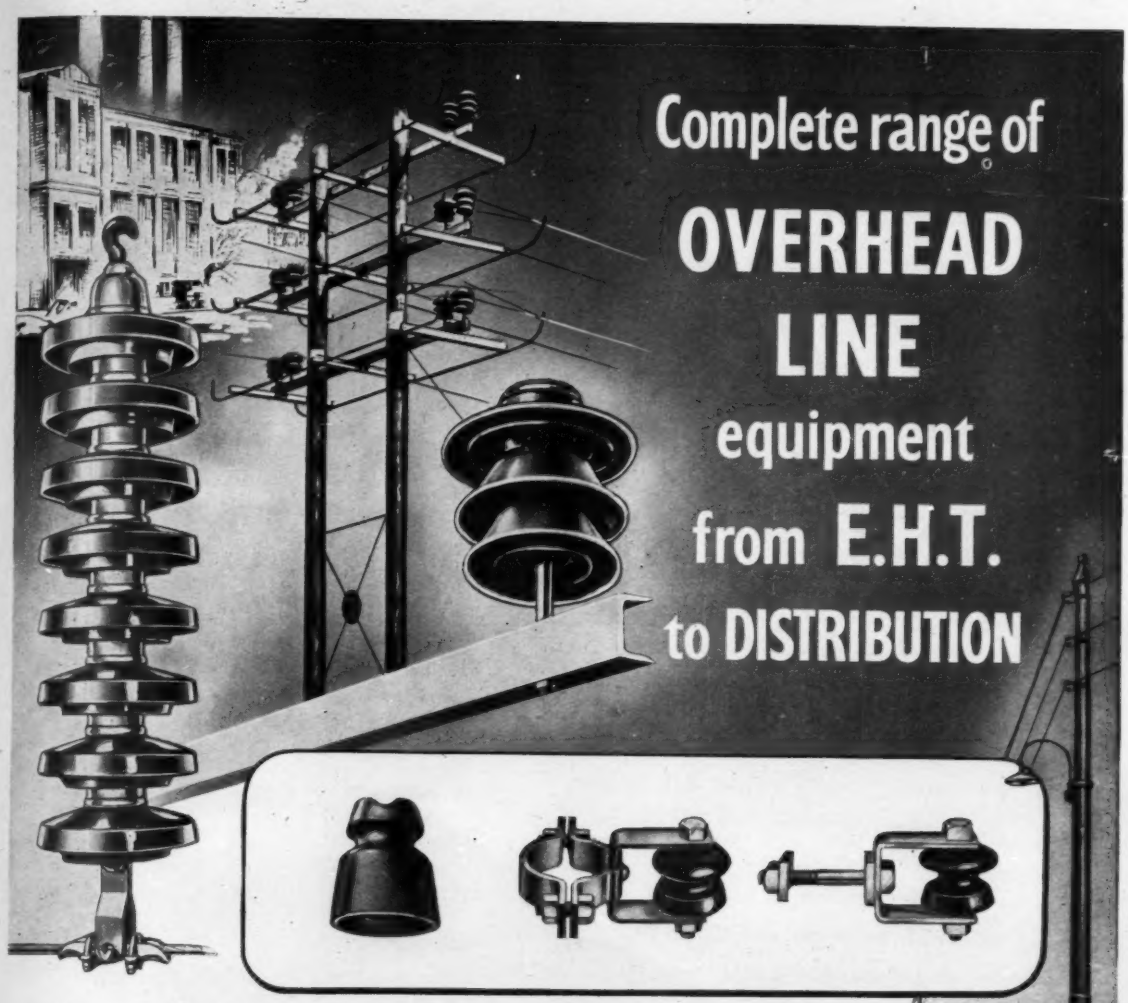
Sunderland.—Additions to X-ray department at Sunderland General Hospital for Newcastle Hospital Board (£19,000); P. H. Knighton, Board's chief architect, Benfield Road, Newcastle-on-Tyne.

Tipton.—Laboratory and offices for British Rolling Mills, Brymill Steel Works; Arthur M. Griffiths & Sons, Ltd., builders, Thomas Street, Wolverhampton.

Watford.—Factory and offices at Holywell, for Abrasive Blades, Ltd.; Davis Scott, Ltd., builders, Faircross House, High Street.

Wolverhampton.—Retail market (£462,000); Wm. Moss & Sons, Ltd., Queens Road, Loughborough, Leics.

York.—Flats (39), Margaret Street, Walmgate; E. Firth, city architect, 8, St. Leonard's Place.



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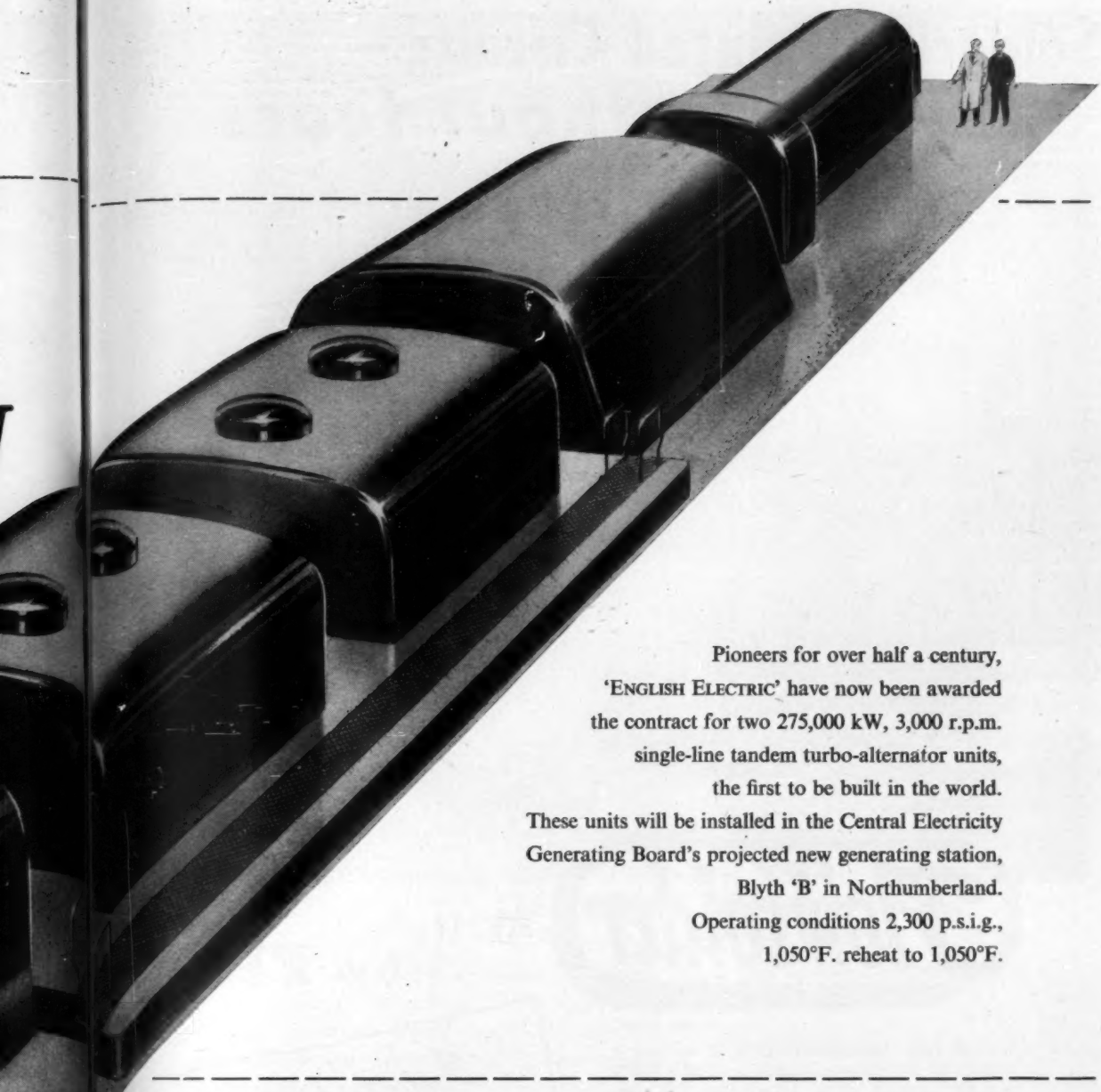

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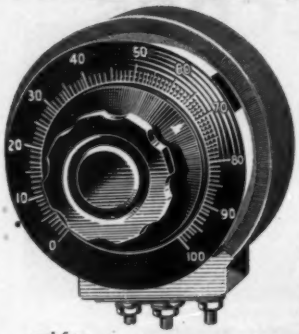

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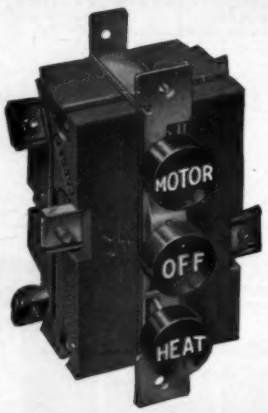

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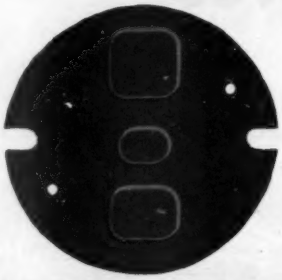
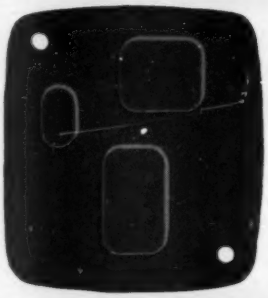


Cat. No.1100 for Ceiling Switches Nos. 8002, 8003, 8008, 8009, 8012 and 8013.



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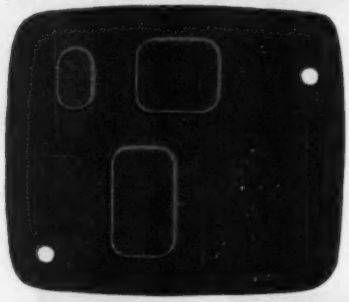
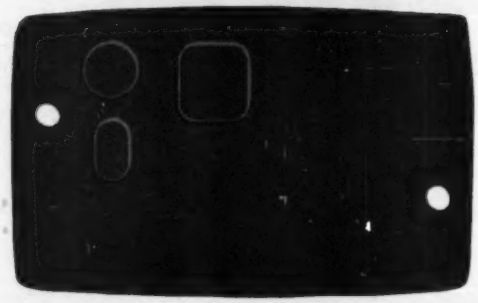


Cat. No.1131 for 13 amp. Switch Sockets Nos.1350, 1351.



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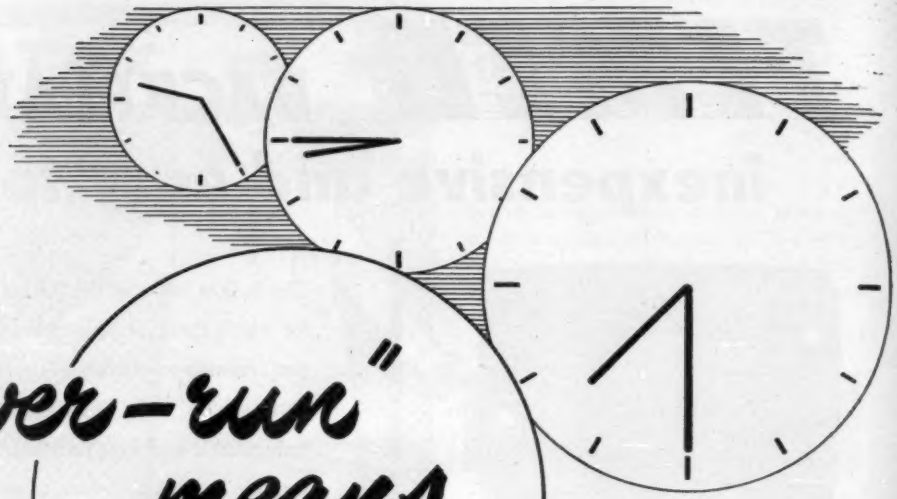

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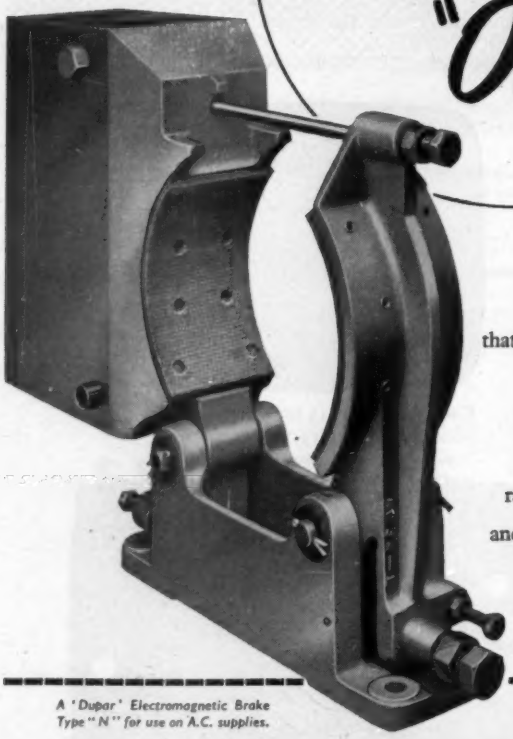

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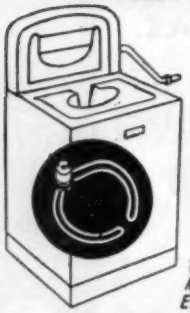

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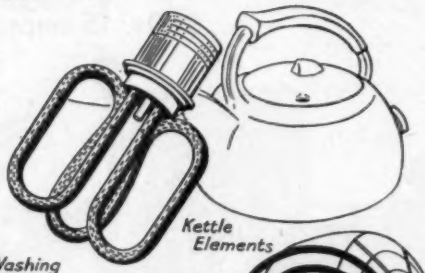

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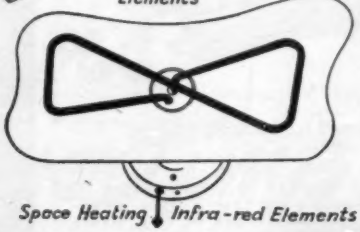
Water Heater Elements

Space Heater Elements



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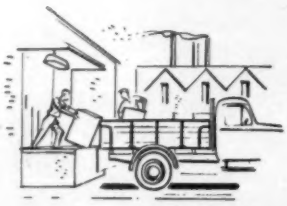
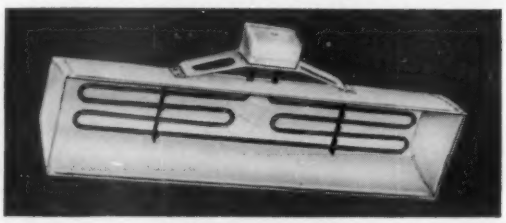


Radiant space heating is the new idea for providing warmth for people at work, waiting in queues, watching games, shopping, etc. Thus in a large building it is possible to direct heat to just those areas where operatives are working.



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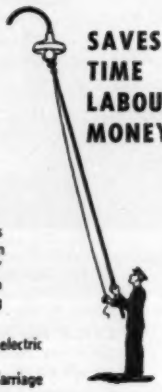

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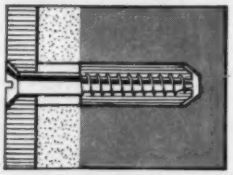

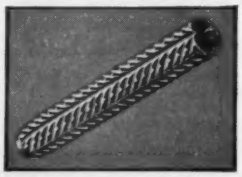

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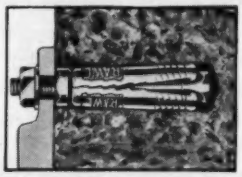

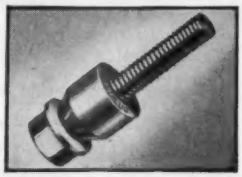

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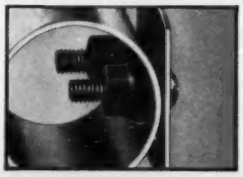

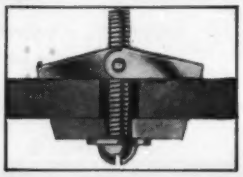

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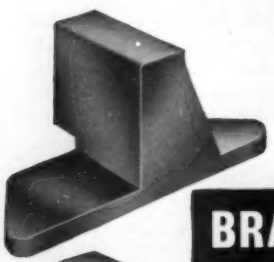

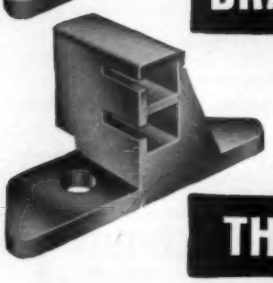

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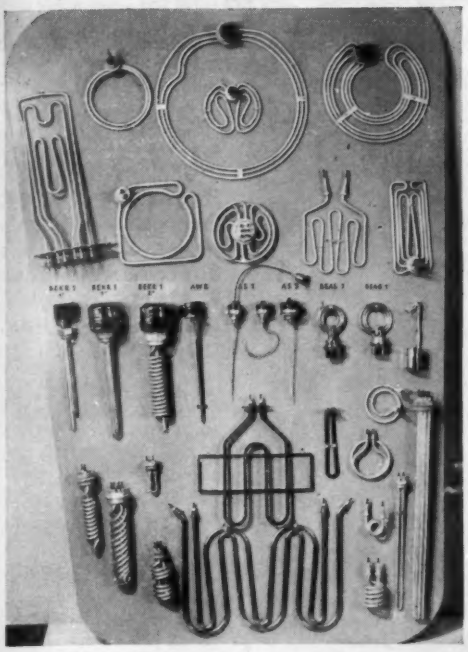

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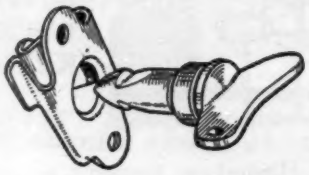

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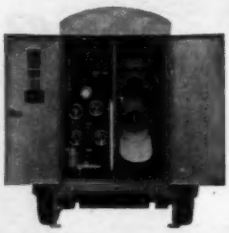

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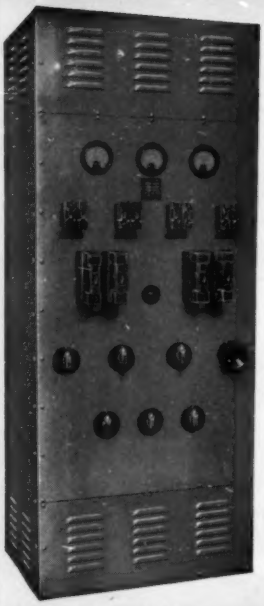

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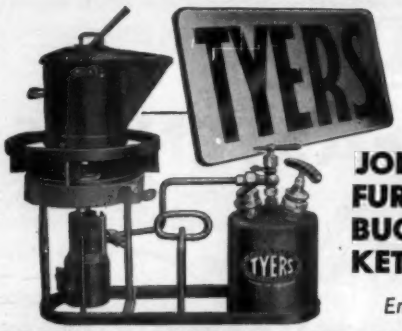

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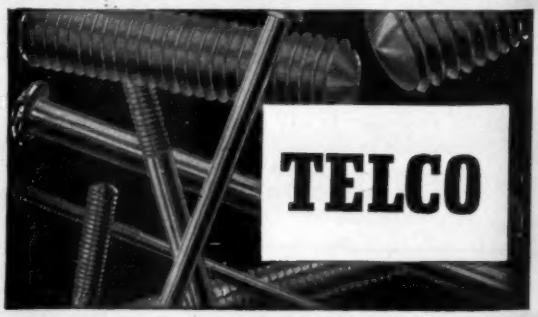

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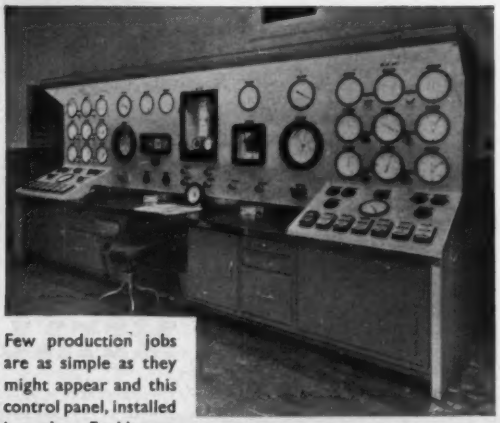

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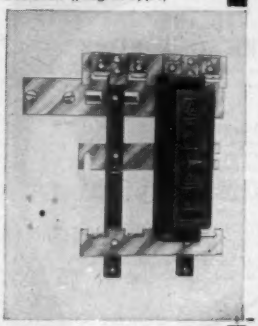

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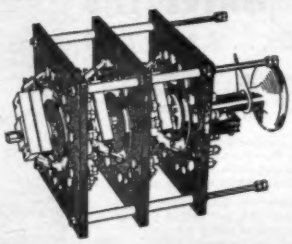

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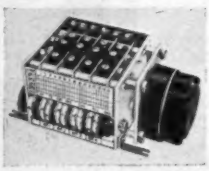

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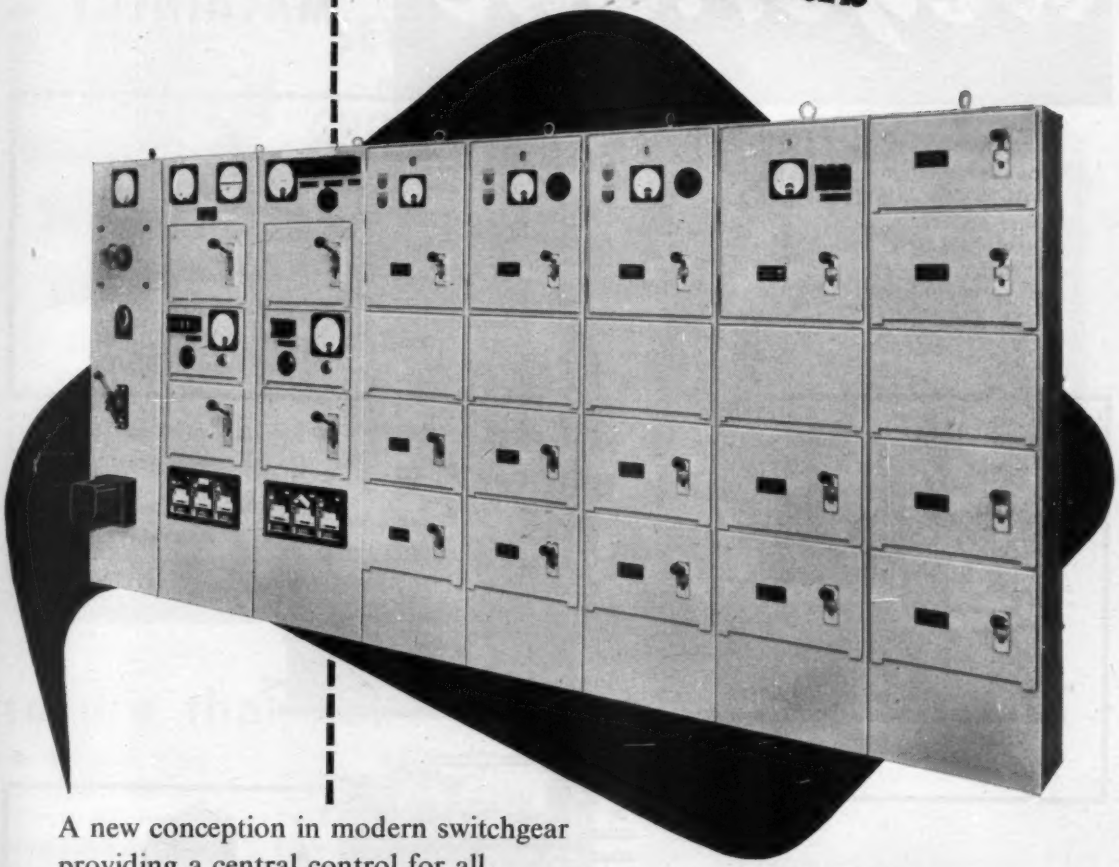

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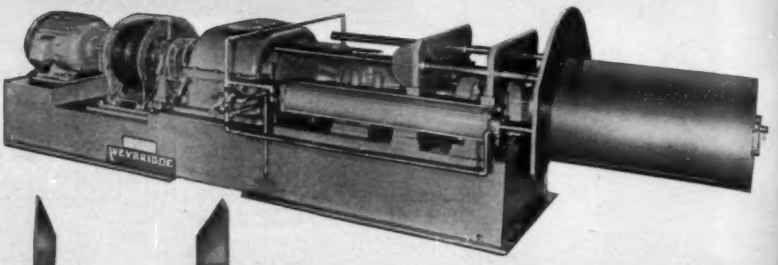

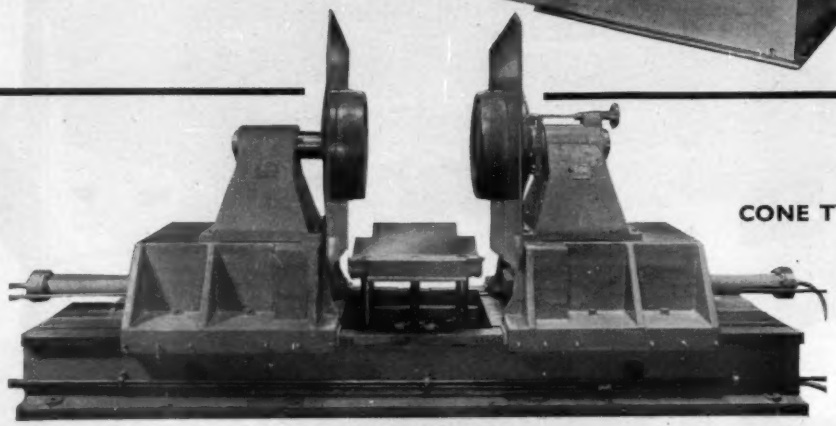

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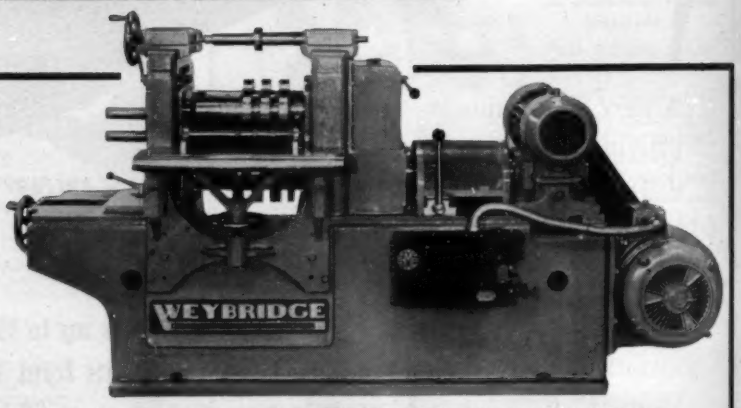

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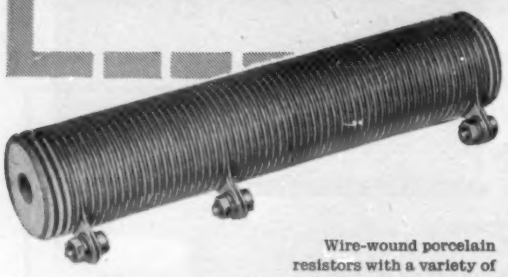

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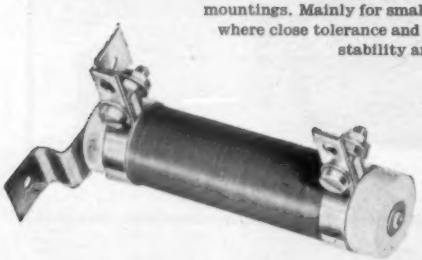

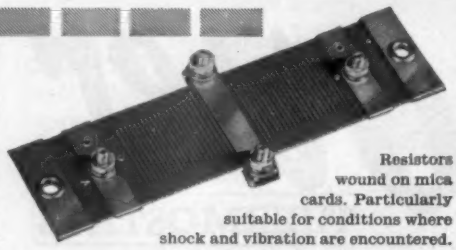

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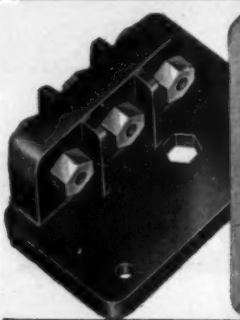

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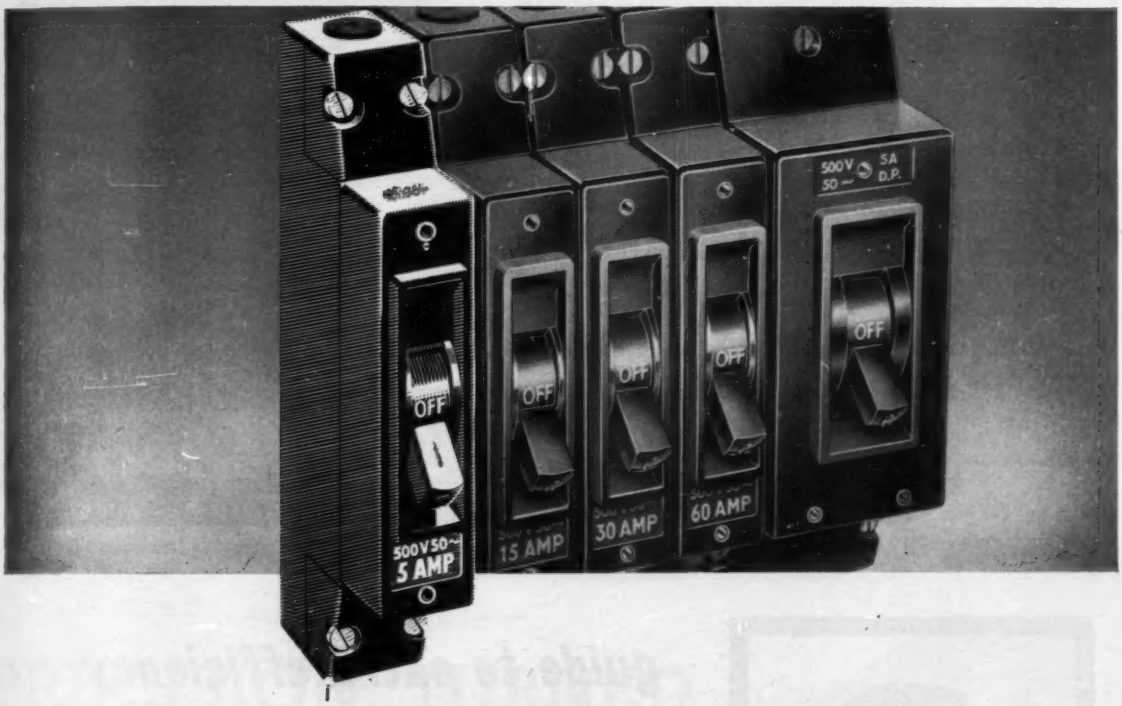

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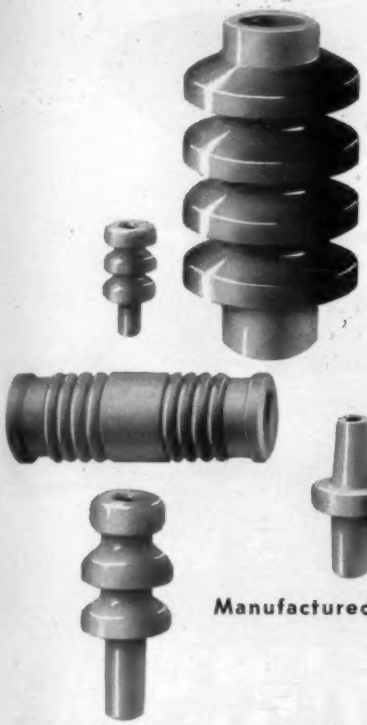

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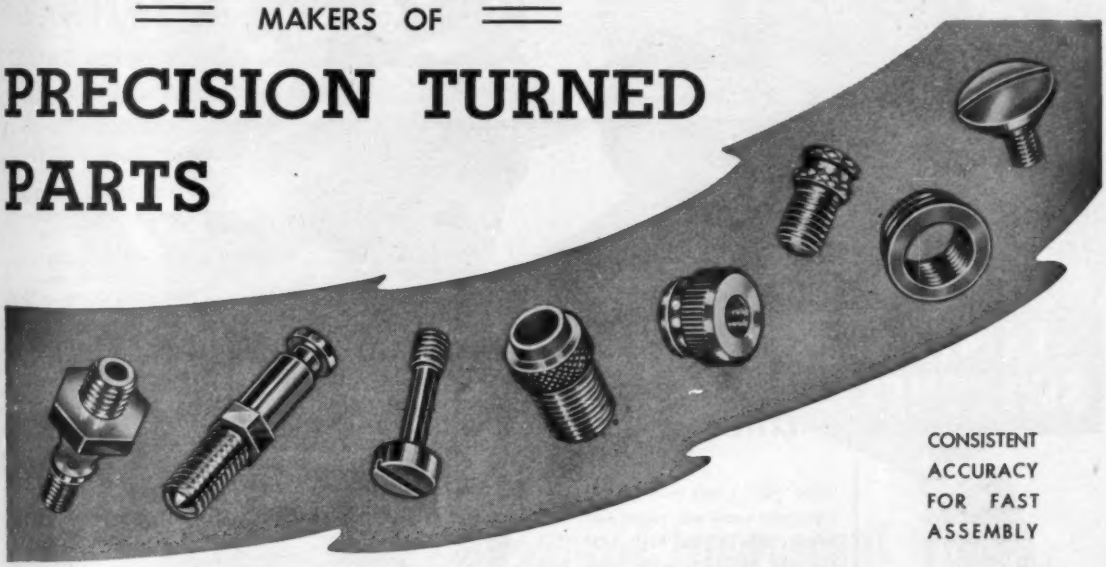

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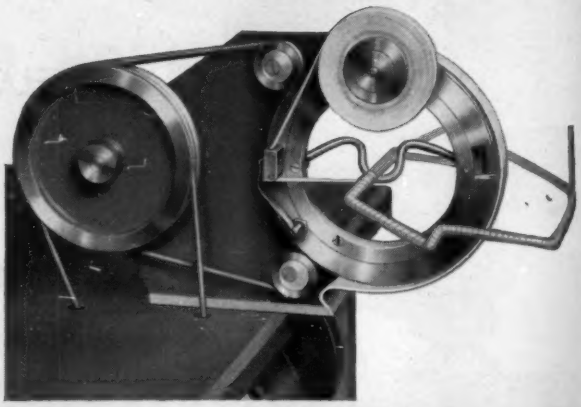

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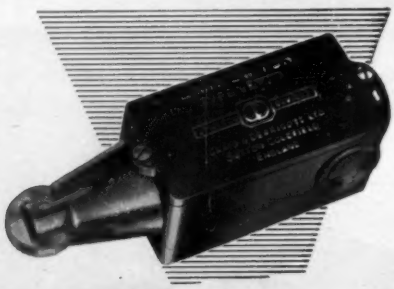

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in heating installation control, combining a Thermostat and a Time Clock in one unit. The control regulates the switch-on time of a heating system over infinitely variable conditions of outside temperature and gives the required temperature at the required time inside the building, thus ensuring the maximum economy of fuel with the maximum comfort, without supervision, on any type of installation.

Specialists of long experience in the design and manufacture of

THERMOSTATS

for electricity, gas, oil or steam

PRESSURE REGULATORS, FLOAT SWITCHES, ETC.

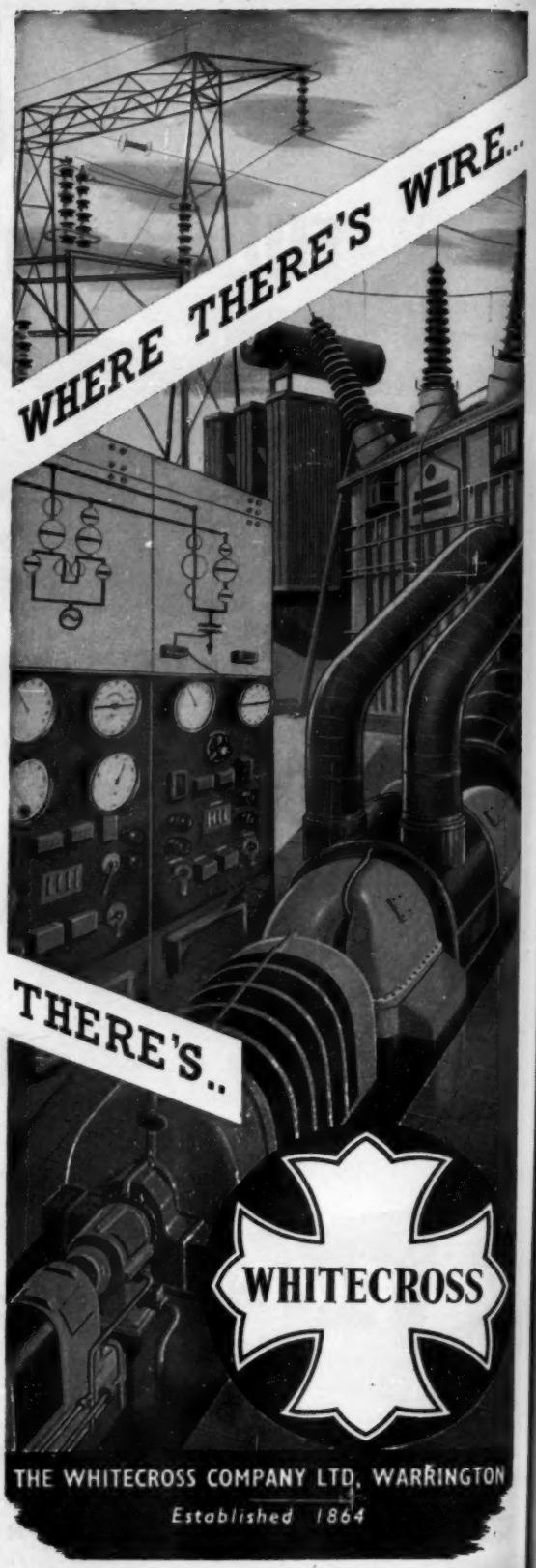
Robert Maclaren & Co. Ltd.

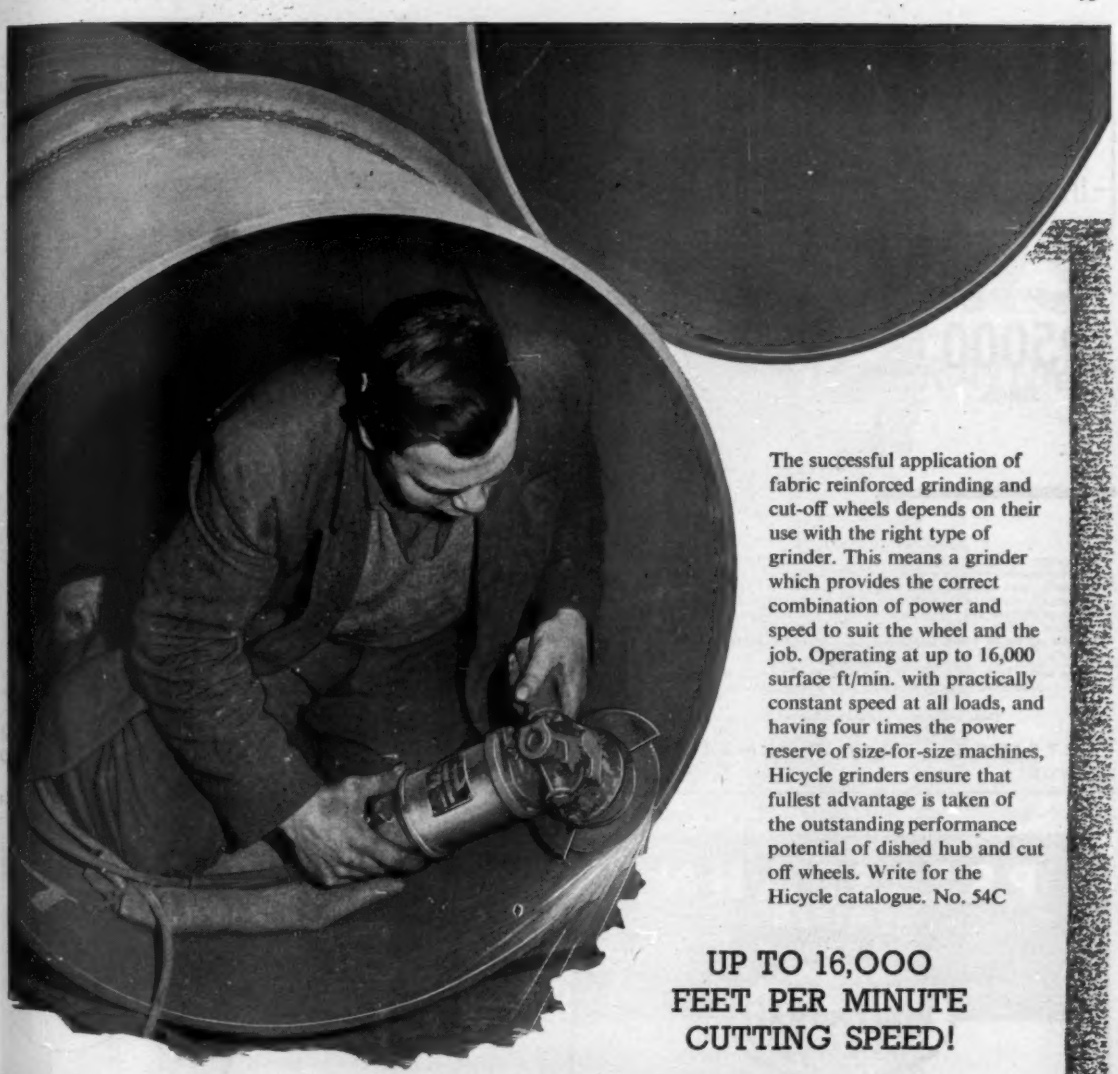
EGLINTON WORKS, KILBIRNIE STREET, GLASGOW, C.5

Phone: SOUTH 2011/2/3 Grams: "SOCKET, GLASGOW"

We are exhibiting at the Electrical Engineers Exhibition Earls Court, 25th–29th March and invite you to visit us on

STAND No. H.6





The successful application of fabric reinforced grinding and cut-off wheels depends on their use with the right type of grinder. This means a grinder which provides the correct combination of power and speed to suit the wheel and the job. Operating at up to 16,000 surface ft/min. with practically constant speed at all loads, and having four times the power reserve of size-for-size machines, Hicycle grinders ensure that fullest advantage is taken of the outstanding performance potential of dished hub and cut off wheels. Write for the Hicycle catalogue. No. 54C

UP TO 16,000 FEET PER MINUTE CUTTING SPEED!

WHAT IS HICYCLE? A range of electric tools for increasing the output per man by stepping up the electricity supply to 200 cycles, thus providing a high, maintained working speed. Other advantages are: greater reliability because there are no armature windings to burn out, greater power with no increase in weight, and absolute safety because of only 72 volts to earth. If you use six or more portable electric tools, you can definitely increase production and reduce maintenance by installing Hicycle.

Hicycle

ELECTRIC PRODUCTION TOOLS

MADE BY

Consolidated Pneumatic

CONSOLIDATED PNEUMATIC TOOL CO. LTD., 232 DAWES ROAD, LONDON, S.W.6.

AIR COMPRESSORS • PNEUMATIC TOOLS • ELECTRIC TOOLS • CONTRACTORS EQUIPMENT • ROCK DRILLS • PUMPS • DIAMOND DRILLS

CP118

A new range of HIGH FIDELITY output transformers

The **PARTRIDGE**

P5000

SERIES

A range of truly "high fidelity" output transformers with superior performance—yet economical design has enabled a price reduction over transformers with less exacting specification. These transformers are especially suited to the well-known Osram and Mullard amplifier designs. The primaries are tapped for ultra linear connection at 43%, and on certain models at 20%, to give optimum performance at various power levels up to 50 watts for operation with such valves as KT88, KT66, EL34, N709, EL84, etc.

The series includes a mains transformer of similar styling with specification to suit the Mullard 5-10 and Osram 912 amplifiers.

Data sheets and price list available on request.

PARTRIDGE TRANSFORMERS LTD.

TOLWORTH · SURREY *Telephone: ELMbridge 6737*

Write for this Handbook

giving full technical information on the "Tophet" range of Stainless Steel Wires which we draw as fine as ·0005".

TOPHET

STAINLESS STEEL WIRES

Manufactured by **GILBY-BRUNTON LIMITED**

HEAD OFFICE & WORKS: SEAMILL, MUSSELBURGH, SCOTLAND

Telephone: Musselburgh 2369

LONDON OFFICE: 47 WHITEHALL, S.W.1. *Tel.: Whitehall 6058*

PRESSPAHN, LIMITED

Manufacturers of

ELECTRICAL WELLSTEAD INSULATION

ELECTRICAL INSULATING MATERIALS

PRESSPAHN, LTD - BRADFORD - YORKS

Phone: Bradford 25135 PBX. Grams & Cables: "Presspahn, Bradford"

'Strip-Clip'

A BETTER SIMPLER QUICKER

way of fixing COPPER EARTHING STRIP . . . at a quarter the cost!

E.D.L.

Once you have used it, it is the ONLY way. Write for list and free samples.

THE ELECTRIC DEPÔT LIMITED

Pritchett Street, Birmingham 6

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When it comes to really good

PRESSURE DIECASTINGS

Consult **MORRIS ASHBY LIMITED**

305 KINGSLAND ROAD, LONDON, E.8

CLISSOLD 2628/9

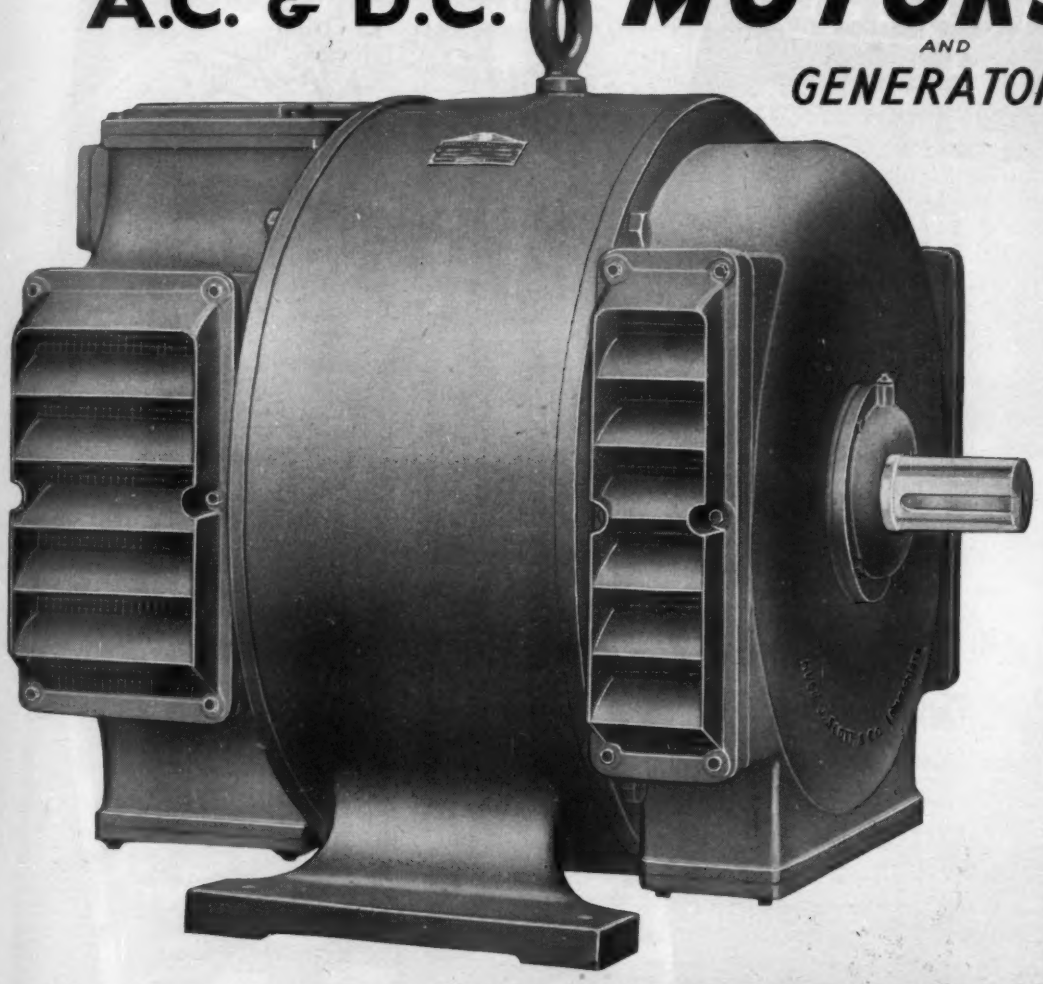
A.I.D. Approved

Scott

H. J. S.

OF NORTHERN IRELAND

A.C. & D.C. MOTORS AND GENERATORS



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INVERTED ROTARY CONVERTERS
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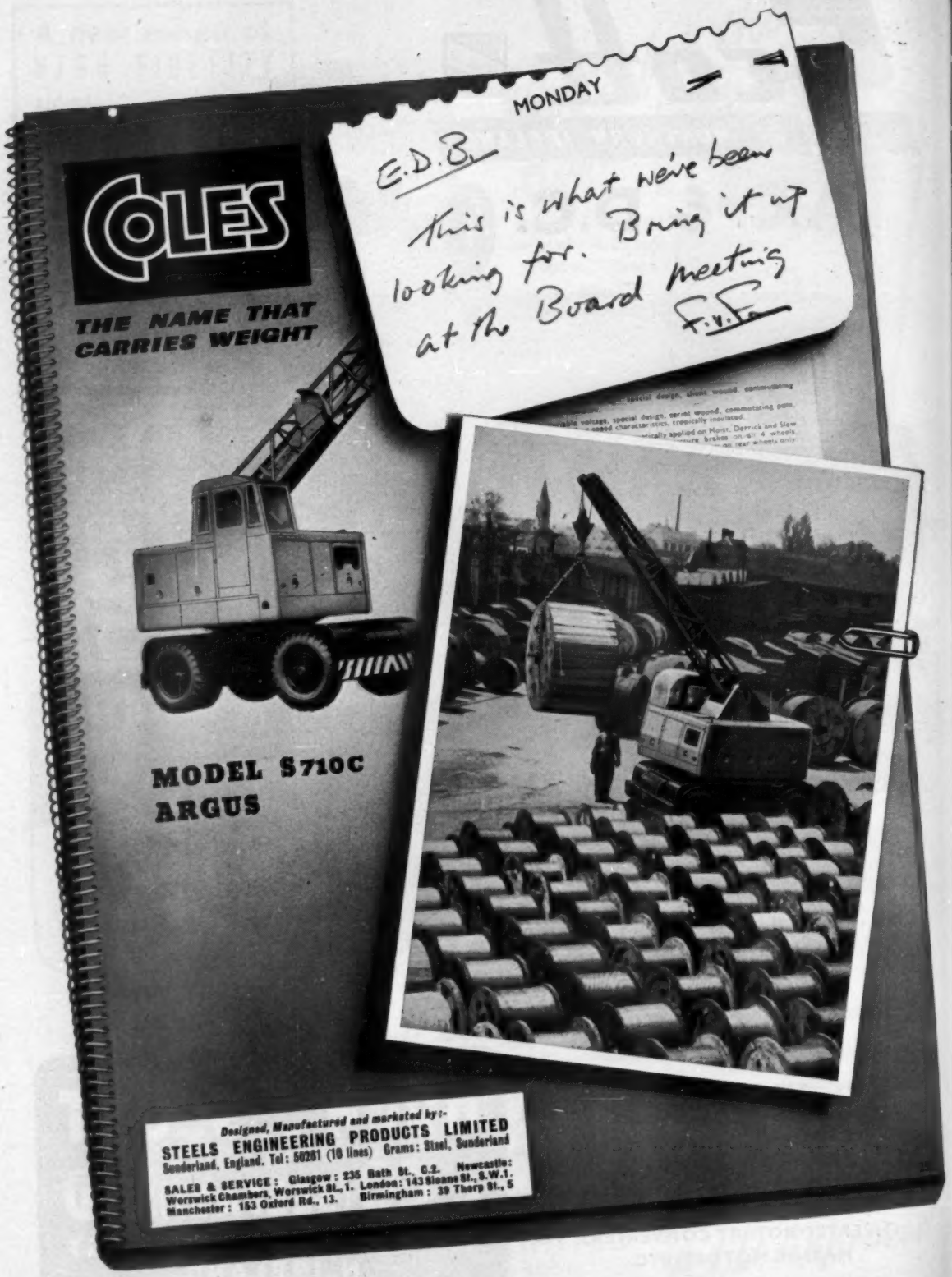
MONDAY
E.D.B.
This is what we've been looking for. Bring it up at the Board meeting
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COLES
THE NAME THAT CARRIES WEIGHT
MODEL S710C
ARGUS
Designed, Manufactured and marketed by:-
STEELS ENGINEERING PRODUCTS LIMITED
Sunderland, England. Tel: 50281 (10 lines) Grams: Steel, Sunderland
SALES & SERVICE: Glasgow: 235 Bath St., C.2. Newcastle: Worswick Chambers, Worswick St., 1. London: 143 Sloane St., S.W.1. Manchester: 153 Oxford Rd., 13. Birmingham: 39 Thorp St., 5

V 162 MR 14 58 UMI

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STAND Nº A1

A.S.E.E. EXHIBITION, EARLS COURT

March 25th-29th, 1958

Aeroflex

AEROFLEX Fluvent

A comprehensive exhibit showing the latest developments in Distribution equipment, from the heavy industrial to the domestic, which will be well worth your visiting.

We shall be particularly pleased to show you our Cabinet Style Distribution Boards with isolators and the latest Fluvent flush fronted Cubicle type Switchboards. See also the 100 kA breaking capacity 600 volt fuses to C.S.A. Approval Code 106 Form 1 and the wide range of Energy Limiting Aeroflex Fuse Links Categories AC4 and AC5, Class P.

Parmiter Hope & Sugden Ltd

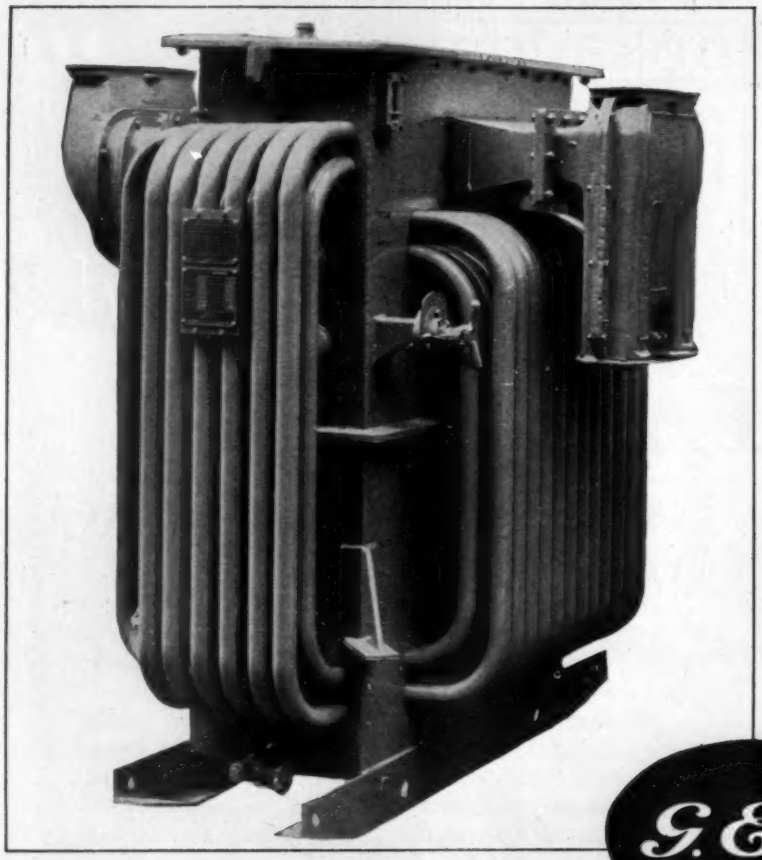
MANCHESTER 12

London: 34 Victoria St., S.W.1. *Glasgow:* 5 Somerset Place, C.2. *Birmingham:* 39/41 Carrs Lane, 4

dm PH148

Built to Central Electricity Generating Board Specification T.1. Available from stock.

5 to 1000 kVA



G.E.C.

transformers

THE GENERAL ELECTRIC CO. LTD., MAGNET HOUSE, KINGSWAY, LONDON, W.C.2

Classified Advertisements

CLASSIFIED advertisements are PREPAID at 3/6 per line (approx. 6 words) per insertion. Where an advertisement includes a Box Number there is an additional charge of 1/-.

DISPLAYED CLASSIFIED:—48/- per inch. Cheques and Postal Orders should be crossed and made payable to ELECTRICAL REVIEW PUBLICATIONS LTD.

SERIES DISCOUNTS for consecutive insertions:—13, 5%; 26, 10%; 52, 15%.

SITUATIONS WANTED:—Three insertions under this heading can be obtained for the price of two if ordered and prepaid with the first insertion.

REPLIES to Box Numbers should be addressed to the Box Number in the advertisement, c/o ELECTRICAL REVIEW, Dorset House, Stamford Street, London, S.E.1, but if not to be delivered to any particular firm or individual they should be accompanied by instructions to this effect, addressed to the Manager of the ELECTRICAL REVIEW. Replies in such cases cannot be returned. The name of an advertiser using a Box Number will not be disclosed.

ADVERTISEMENTS are accepted up to **First Post on Monday of the week** of issue and should be addressed to ELECTRICAL REVIEW, Classified Advertisement Department, Dorset House, Stamford Street, London, S.E.1.

Original testimonials should not be sent with applications for employment

OFFICIAL NOTICES, TENDERS, ETC.

BOLDON URBAN DISTRICT COUNCIL

Main Road Lighting

(1) **Road A.183. Whitburn to Marsden**
(2) **Road A.19. Cleadon**
(3) **Road B.1299. East Boldon to Cleadon**
(4) **Road C.90. West Boldon**

TENDERS are invited for the supply and erection of Group A Street Lighting installations for the above classified roads as follows:

(i) Supply of lanterns, lamps, brackets and electrical equipment.

(ii) Supply and erection of steel columns and fitting and wiring of the electrical equipment, etc., in (i) above, provided by the tenderer.

(iii) Supply and erection of steel columns and fitting and wiring of electrical equipment, etc., in (i) above but provided by another firm.

The specification, bill of quantities and form of tender may be obtained from, and conditions of contract and drawings inspected at, the office of the Engineer and Surveyor, Council Offices, East Boldon, County Durham, on payment of a deposit of £2 2s., returnable on receipt of a bona fide tender, not subsequently withdrawn, and the return of all documents.

Tenders in envelopes endorsed "Tender for Main Road Lighting" to be delivered to the undersigned not later than noon on Tuesday, 8th April, 1958.

The Council do not bind themselves to accept the lowest or any tender.

J. McGILLIVRAY,
Clerk of the Council.

Council Offices,
East Boldon,
County Durham. 2650

COUNTY BOROUGH OF BLACKPOOL

Illuminations and Street Lighting Department

TENDERS are invited for the supply and delivery of the following equipment:—

21 Group "A" Prestressed Spun Concrete Street Lighting Columns.

22 Group "A" Fluorescent Street Lighting Lanterns.

Specifications, forms of tender and general conditions may be obtained from the Illuminations and Public Street Lighting Officer, Illuminations and Street Lighting Department, Rigby Road East, Blackpool.

Tenders must be enclosed in the addressed envelope provided, and sealed, and must reach the undersigned not later than 2.30 p.m. on Monday, 14th April, 1958.

ERNEST C. LEE,
Town Clerk. 2673

WILTS COUNTY COUNCIL

TENDERS invited for the installation of the Electrical System in the new Primary School, Bath Road, Cricklade.

Applications, with a deposit of £2 2s. (cheques only, payable to the Wilts County Council), to be made by Friday, 21st March, 1958, on or about which date specifications and plans will be issued.

No pledge is given to accept the lowest or any tender.

P. A. SELBORNE STRINGER,
Clerk of the County Council.

County Hall,
Trowbridge. 2738

WEST LANCASHIRE RURAL DISTRICT COUNCIL

Street Lighting: Parishes of Rufford, Tarleton and Ince Blundell

THE Council invite tenders for the proposed supply, erection and commissioning of the following Class "A" Lighting Schemes:—

(a) Liverpool Road, A59, Rufford. 42 positions.

(b) Liverpool/Preston/Southport Road, A59/A565, Tarleton. 23 positions, including 2 double brackets.

(c) Southport Road, A565, Ince Blundell. 13 positions.

All the above will use 140-w. Sodium Lamps mounted on Concrete Columns.

Tenders may be submitted for any or all of the following three sections:—

(a) Supply of concrete columns and brackets.

(b) Supply of transformers, capacitors, discharge lamps and lanterns.

(c) Erection of concrete columns and brackets; fitting and wiring of electrical equipment; supplying and fixing of time-switches, fuses and all requisites not supplied in (a) or (b); removal of redundant equipment, and putting the completed installation into commission.

Specification, bills of quantities and form of tender can be obtained from the Engineer and Surveyor, West Lancashire Rural District Council, Council Offices, Derby Street, Ormskirk, on payment of a deposit of two guineas, which will be refunded on the receipt of a bona fide tender FOR ALL THREE SCHEMES, not subsequently withdrawn. Plans of the schemes may be inspected at the above Council Office.

Sealed tenders in plain envelopes and marked "Street Lighting" must be delivered to the undersigned not later than 10 a.m. on Friday, 21st March, 1958.

WILLIAM RIGBY,
Clerk of the Council.

Council Offices,
52, Derby Street,
Ormskirk. 2722

INDIA STORE DEPARTMENT

THE Director-General, India Store Department, Government Building, Bromyard Avenue, London, W.3, invites tenders for the supply of:—

Wireless Set No. 19:
Microphone and Receiver Headgear Assy. No. 10: Qty. 2,900.

Forms of tender, which are returnable by the 14th April, 1958, may be purchased at the above address at a cost of 10s., which is not returnable.

Reference 3634/57/AJS/ET must be quoted on all applications. 2672

CORPORATION OF DUNDEE

Trunk Road A.972, Street Lighting

THE Corporation invite offers for the supply of Concrete Columns, Lanterns, Sodium Lamps and Auxiliary Gear. Specification and form of tender may be obtained from the Public Lighting Engineer, 46, Dens Road, Dundee.

Sealed offers endorsed "Public Lighting Department — Concrete Columns, Lanterns, Lamps and Auxiliary Gear" to be lodged with the subscriber on or before 31st March, 1958.

ROBERT LYLE,
Town Clerk.

City Chambers,
Dundee. 2721

CITY OF HEREFORD

Tenders for Street Lighting

TENDERS are invited for the provision, erection and putting into service of 73 Group "B" Lighting Columns with Sodium Discharge Lamps on roads in the City.

Specifications, schedules and form of tender may be obtained from Mr. F. Margerison, A.M.I.C.E., City Surveyor, Town Hall, Hereford, on receipt of a deposit of £2 2s., which will be returned on receipt of a bona fide tender.

Plans and conditions of contract may be inspected at the same office during normal office hours.

Tenders, endorsed "Street Lighting," in the envelope provided, and bearing no name or mark to indicate the sender, must reach the undersigned not later than 9 a.m. on the 14th April, 1958.

The Council does not bind itself to accept the lowest or any tender.

T. B. FELTHAM,
Town Clerk.

Town Hall,
Hereford. 2690

COUNTY OF LEICESTER

CONTRACTORS with adequate facilities to complete in limited period invited to tender for supply and installation of New Automatic Switchboard for existing internal telephone system at County Offices, Grey Friars, Leicester.

Applications for specifications to County Architect, 123, London Road, Leicester, by 21st March. Deposit £2 2s., returnable on receipt of bona fide tender. Tenders to be returned not later than 1st April. 2704

SITUATIONS VACANT

THE ELECTRICITY COUNCIL

General Assistant Engineer

THE ELECTRICITY COUNCIL requires a GENERAL ASSISTANT ENGINEER in the Commercial and Development Department. Duties will include technical and statistical analysis of comprehensive data from tests on various types of electric heating installations and on load characteristics of consumer, and may involve occasional travelling. Candidates should have the H.N.C. or equivalent.

Salary N.J.B. Grade 5, £590 - £765 p.a. inclusive.

Applications stating age, qualifications, experience, present position and salary to E. Landucci, Winsley Street, London, W.1, to arrive not later than 28th March, 1958. Quote ref. C/7. 2707

SOUTH OF SCOTLAND ELECTRICITY BOARD

APPLICATIONS are invited for a position as SHIFT CHARGE ENGINEER at Kilmarnock Generating Station.

Applicants should have had generating station experience and, preferably possess a Higher National Certificate in Electrical or Mechanical Engineering. Salary N.J.B. Class F, Grade 7, £885/£930 per annum (plus shift allowance of 10%).

The position is superannuable. Forms of application may be obtained from Secretary, South of Scotland Electricity Board, 168, Broomhill Drive, Glasgow, W.1, and should be returned not later than 21st March, 1958. 2740

Situations Vacant (continued)

CENTRAL ELECTRICITY GENERATING BOARD

East Midlands Division

APPLICATIONS are invited for the following appointments in this Division :—

PLANT SHIFT CONTROL ENGINEERS, CASTLE DONINGTON POWER STATION
(Vacancy No. 35/58/ER).

Experience desirable in control of boilers and turbines at high pressure and temperature, pulverised fuel, together with electrical control room experience.

Technical qualifications to Higher National Certificate desirable.

Salary will be in accordance with Class I, Grade 10 (£995-£1,055 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 19th March, 1958.

THIRD ASSISTANT ENGINEER (Electrical), DIVISIONAL HEADQUARTERS
(Vacancy No. 43/58/ER).

Applicants should have had a fundamental training in electrical engineering, including workshops, and should preferably have had experience in the manufacture, erection and maintenance and operation of electrical plant as installed in modern power stations. Preference will be given to candidates who possess a degree or are Graduate Members of the Institution of Electrical Engineers.

Salary will be within Class AX/EX, Grade 6 (£895-£1,140 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 26th March, 1958.

GENERAL ASSISTANT ENGINEER
(Amended Advertisement),
AVON POWER STATION, WARWICK
(Vacancy No. 38/58/ER).

The suitable applicant will be given the opportunity to obtain operating and maintenance experience at this power station.

Applicants should be in possession of suitable engineering qualifications.

Salary will be within the range £540-£635 per annum in accordance with the National Joint Board Agreement.

Closing date for receipt of applications, 19th March, 1958.

These appointments will be pensionable under the terms of the Staff Superannuation Scheme.

Applications should be submitted on the official form AE6/ACT, which may be obtained from the Divisional Establishments Officer, Central Electricity Generating Board, East Midlands Division, P.O. Box 25, Barker Gate, Nottingham, and should be returned to the undersigned by the date stated. PLEASE QUOTE VACANCY NUMBER.

L. F. JEFFREY,
Divisional Controller.

5th March, 1958. 2727

FEDERATION OF NIGERIA

ELECTRICAL ENGINEER, INLAND WATERWAYS DEPARTMENT. To repair and maintain all electrical machinery in two inland waterway dockyards. To design and prepare estimates for future expansion and set up an electrical repair section. To maintain echo sounding machines, launch refrigeration systems and small h.p. motors and generators used in launches.

Contract appointment in the salary range £1,290 to £1,962 p.a. plus a gratuity of £37 10s. for each 3 months' satisfactory service. Quarters if available at low rental. Free passages for officer and wife, and children up to cost of two adult fares or an allowance of £75 for each of two children maintained in U.K. Free medical and dental treatment.

Candidates, between 28 and 35, must be A.M.I.E.E., or be exempt from the Institution's examination. They should have had experience in all classes of installation from estimates to completion of large buildings oil engine standby generating plant. Should have had experience in the repair and maintenance of echo sounding equipment, etc.

Write, stating age, qualifications and experience, to Director of Recruitment, Colonial Office, London, S.W.1. Quote BCD.513/14/03. 2723

KAMPALA MUNICIPAL COUNCIL

Appointment of Works Supervisor (Electrical)

APPLICATIONS are invited for the above post in Council's Sewage Disposal Works in Council's Salary Scale IV, £879 × £33 to £945 × £36 to £1,017 × £39 to £1,173 × £42 to £1,341 (including inducement pay). The commencing salary within this scale will depend upon the qualifications and experience of the successful applicant.

Applicants must be capable of maintaining electrically driven machinery consisting of rag pickers, conveyors, scrapers, and water and sludge pumps of up to 1,100 g.p.m. each. Preference will be given to applicants with suitable experience in the maintenance of electrical equipment comprising motors from one to fifty h.p. with relevant switchgear and controls, etc. Experience in a modern sewage purification works or water works will be an additional advantage.

The appointment is to Council's permanent staff under Part I of Council's Regulations and Terms of Service, which includes home leave after thirty to thirty-six months and up to four adult passages for expatriate officers and their families. Free medical and dental benefits are provided and housing complete with heavy furniture at a low rental.

The successful applicant, if less than 50 years of age, will be required to contribute to Council's superannuation scheme at the rate of 7½% of salary. If over 50 years of age a provident fund scheme is in operation.

Canvassing of members of the Council directly or indirectly in connection with this appointment will disqualify. The appointment will be subject to a probationary period of at least six months, and the selected candidate would be required to submit to a medical examination before appointment.

Applications giving full particulars, including age, marital status, qualifications, previous experience and the date when the applicant would be free to take up duties, together with the names and addresses of three persons to whom reference can be made, must reach the Town Clerk, P.O. Box 210, Kampala, Uganda, not later than the 29th March, 1958. 2674

MICHELIN TYRE CO. LTD.

Stoke-on-Trent

have progressive openings for

DESIGNER / DRAUGHTSMEN

with H.N.C. (Electrical), or O.N.C. and now studying for H.N.C., for interesting work on motor applications, lighting schemes and general factory electrical services.

Good commencing salaries related to qualifications and experience are offered plus a contributory pension scheme, free life assurance and excellent welfare facilities.

ASSISTANCE WITH HOUSING WILL BE GIVEN IF REQUIRED

Please write in confidence to:—

Mr. A. C. McCombie

c/o above

quoting reference B3/ER

2594

CONSULTING ENGINEERS

require ELECTRICAL ENGINEER in WINCHESTER for supervision of construction and commissioning tests on Grid substations. Graduate standard and appropriate practical experience essential, also driving licence. Age 25-30 preferred.

Apply Kennedy & Donkin (HJP/MVR), 12, Caxton, Street, London, S.W.1. 2731

WALSALL AND STAFFORDSHIRE TECHNICAL COLLEGE

Principal: H. Cheetham, B.Sc.(Hons.), A.M.I.Mech.E., M.I.Prod.E.

LECTURER IN ELECTRICAL ENGINEERING

APPLICATIONS for the above post are invited from graduates in electrical engineering able to teach Electrical Engineering subjects, including Electrical Machines, to Higher National Certificate standard. Duties to commence on 1st May, 1958.

Salary will be in accordance with the Burnham Technical Report, 1956, viz.: £1,200 by £30 to £1,350 p.a.

Application form and further particulars may be obtained from the Principal, Walsall and Staffordshire Technical College, Wisemore, Walsall, Staffs., to whom completed application form should be returned not later than Friday, 28th March, 1958.

V. MILLSON,
Secretary to the Governors.

2725

THE NUCLEAR POWER PLANT COMPANY LIMITED

ENGINEERS

required

for commissioning Nuclear Power Station Reactors.

Applicants should hold a degree in Mechanical or Electrical Engineering and have had subsequent experience in industry.

Training in reactor engineering will be given to selected candidates.

Written applications, giving full details of qualifications and experience, should be addressed to:

The Secretary

THE NUCLEAR POWER PLANT COMPANY LTD.

Booths Hall

Knutsford, Cheshire

Quoting reference CMS/ER/37.

2744

POWER CONTROL ENGINEERS

THE UNITED KINGDOM ATOMIC ENERGY AUTHORITY, Industrial Group, requires POWER CONTROL ENGINEERS at Calder Works, Calderbridge, Cumberland, to be responsible, on shift, to the Assistant Power Manager for the safe and efficient operation of the power generating plant in a nuclear power station.

A recognised engineering apprenticeship and considerable experience in the operation of boilers, turbo-alternators and E.H.V. switchgear are required. Possession of an appropriate H.N.C. or equivalent may be an advantage.

Salary assessed within scale £1,050-£1,270. Contributory pension scheme.

Housing or assistance towards legal expenses on house purchase may be available.

Send POSTCARD for application form, quoting reference 2336, to Works Secretary, U.K.A.E.A., I.G., Windscale Works, Sellafield, Calderbridge, Cumberland.

Closing date 31st March, 1958. 2705

NORTH OF SCOTLAND HYDRO-ELECTRIC BOARD

Breadalbane Generation Group

APPLICATIONS are invited for the following appointments with headquarters in Glen Lochay, Killin, Perthshire :—

MAINTENANCE ENGINEER. Applicants should have had a sound technical training in, the construction and maintenance of large turbo-alternators, E.H.T. and L.T. switchgear, automatic control equipment and protective devices. They should preferably have technical qualifications up to H.N.C. standard. Salary Schedule A, Grade F/6, £935/£995 p.a.

SHIFT CHARGE ENGINEER. Applicants should preferably have technical qualifications up to H.N.C. standard and have experience in the operation of hydro-electric generating plant and high-voltage switchgear. Salary Schedule A, Grade F/7, £885/£930 p.a. plus ten per cent shift allowance.

ASSISTANT ENGINEER (Technical). Candidates should have experience in the operation and maintenance of some of the following: remote control, metering and indicating equipment, carrier telephone and telegraph transmission equipment, V.H.F., radio and general signalling equipment. The possession of a final Group Certificate in Telecommunications of the City and Guilds of London Institute would be an advantage. Salary Schedule A, Grade F/9, £790/£835 p.a.

All positions are superannuable and a Board's staff house can be made available to successful candidates.

Applications stating experience, qualifications and age should be submitted to Generation Engineer, Glen Lochay, Killin, Perthshire, not later than fourteen days from the date of this notice. 2708

GOVERNMENT OF BAHRAIN

Bahrain State Electricity Department

GENERATION ENGINEER required to take charge of diesel engine, dual fuel engine and gas turbine generating plant with associated auxiliary equipment in two power stations.

Station "A" comprises an installed capacity of 4,500-kW diesel engine-driven alternators, and Station "B" 4,000-kW dual fuel engine-driven alternators and 3 6,100-kW Brown Boveri gas turbo-alternators, the latter plant in course of erection with the first unit to be commissioned for summer 1958.

Preference will be given to candidates between 35/45 years of age with qualifications equivalent to Associate Membership of the Institutions of Electrical or Mechanical Engineers and having had operating experience on similar generating plant for at least 5 years.

Consolidated commencing salary up to £2,250 per annum according to qualifications and experience. There is also a pension fund.

Free furnished bachelor quarters and medical attention provided. Married accommodation provided after satisfactory completion of six months probationary period. Contract in the first place for a period of two years subject to six months probation. Leave is granted at the rate of ten weeks per annum and free passages by air to and from London are provided for the successful candidate and his wife every two years.

Applications in the first instance giving full details of qualifications, training and experience to be addressed to the Personnel Officer, EWBANK AND PARTNERS LIMITED, 10/11, Grosvenor Place, London, S.W.1. 2691

HEAD WRIGHTSON IRON & STEEL WORKS ENGINEERING LIMITED

require

ELECTRICAL DRAUGHTSMEN

for the layout and design of industrial installations comprising power distribution, motor applications, lighting and allied design work. Experience of iron and steel works practice an advantage but not essential.

Excellent working conditions, pension scheme, assistance with house purchase.

Apply Personnel Manager, Ref. I.S./ER/19, Teesdale Iron Works, Thornaby-on-Tees. 2696

YORKSHIRE ELECTRICITY BOARD

No. 5 (Wakefield) Sub-Area

DONCASTER DISTRICT, ENGINEERING DRAUGHTSMAN.

Applicants should have a good knowledge of the theory and principle applicable to the design, layout and construction of buildings, including site surveys. Experience in the making of and filing distribution mains records is desirable and a knowledge of electrical plant and equipment would also be an advantage but is not essential.

The successful applicant will be required to supervise the drawing office staff in the district drawing office under the supervision of the district engineer.

Salary N.J.B. Schedule D, Grade 6, £595/£20/£715 per annum.

Applications giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 5 (Wakefield) Sub-Area, Yorkshire Electricity Board, 12, Denby Dale Road, Wakefield, not later than 28th March, 1958. 2743

THE NUCLEAR POWER PLANT COMPANY LIMITED

requires two

COMMISSIONING ENGINEERS

The vacancies are for a Steam Turbine Commissioning Engineer and a Boiler Commissioning Engineer.

Applicants for the former position should preferably have had steam turbine design experience, and for the latter experience in boiler or heat exchanger design.

Both appointments call for capable engineers with good practical experience of the installation and commissioning of modern power station equipment.

Written applications, giving full details of qualifications and experience, should be addressed to:

The Secretary

THE NUCLEAR POWER PLANT COMPANY LTD.

Booths Hall

Knutsford, Cheshire

Quoting reference CMS/ER/36.

2745

LONDON COUNTY COUNCIL

Hackney Technical College

ASSISTANT GRADE B for additional post from 1st September, 1958. Electrical Engineering and Physics to at least O.N.C. level. Must be graduate or hold fully equivalent qualification with some teaching industrial and/or professional experience.

Burnham F.E. scale, £650 × £25 to £1,025 plus London allowance. Additions for qualifications and training; increments within scale for approved industrial experience (maximum of 12 years from age of 21).

Application form from Secretary, Dalston Lane, London, E.8, to be returned by 28th March, 1958. (397) 2724

SENIOR DRAUGHTSMAN

required for progressive company of Electrical/Mechanical Engineers, with experience on L.T. switchgear and fuseboards.

Apply Chief Draughtsman, Peppers of Woking Ltd., Stanhope Road, Camberley, Surrey. 2761

WESTINGHOUSE BRAKE & SIGNAL CO. LTD.

Rectifier Engineering Department

Chippenham

TWO ELECTRO-MECHANICAL ENGINEERS are required for the development and design of rectifier assemblies, housings, cooling devices and structures for copper-oxide, selenium, germanium and silicon rectifiers. The rectifiers and their cooling arrangement will be applied in many different types of equipment, the rectifier powers of which will range from milliwatts to megawatts. The work will, therefore, be new, varied and interesting.

A previous knowledge of semi-conductors is not essential as training in this subject will be given.

Candidates should have served an apprenticeship, or had equivalent industrial experience, and have taken a Degree or Higher National Certificate course.

If you are interested in these posts, which offer good opportunities, write to :—

Chief Rectifier Engineer,
Westinghouse Brake & Signal Co. Ltd.,
Engineering Dept.,
New Road, Chippenham, Wilts.
(Telephone: Chippenham 2881).

Please give brief details of your age, qualifications, training and present salary, and state whether, if selected, an interview in London or Chippenham is preferred.

2598

GOVERNMENT OF BAHRAIN

Bahrain State Electricity Department

FIVE SHIFT CHARGE ENGINEERS required for a new power station comprising 4 1,000-kW dual fuel engine-driven alternators and 3 6,100-kW Brown Boveri gas turbo-alternators, the latter plant now in course of erection with the first unit to be commissioned for summer 1958.

Preference will be given to candidates between 30/45 years of age with qualifications equivalent to H.N.C., B.O.T. (Steam and Diesel) or C.E.R.A., who have had operating experience on similar generating plant for at least 5 years.

Consolidated salary equivalent to £1,550 per annum. There is also a pension fund.

Free furnished bachelor quarters and medical attention provided. Married accommodation provided after satisfactory completion of six months probationary period. Contract in the first place for a period of two years subject to six months probation. Leave is granted at the rate of ten weeks per annum and free passages by air to and from London are provided for the successful candidate and his wife every two years.

Applications in the first instance giving full details of qualifications, training and experience to be addressed to the Personnel Officer, EWBANK AND PARTNERS LIMITED, 10/11, Grosvenor Place, London, S.W.1. 2692

ELECTRICAL DESIGNER-DRAUGHTSMAN

required by

W. H. ALLEN SONS & CO. LTD.
BEDFORD

for the development and design of A.C. and D.C. motor control gear.

This is a permanent appointment on interesting work with good prospects.

Generous pension scheme. Assistance towards removal expenses.

Apply in writing, giving full details of experience, to the Personnel Manager. 2712

CHIEF ELECTRICAL DESIGNER

for rotating machines, alternators and D.C. generators up to 100 kVA required by small firm in Birmingham area.

Applicants will be responsible only to directors and should possess a University Degree or Higher National Certificate.

State age, experience, present position and salary in strict confidence to—Box 2508.

Situations Vacant (continued)

NORTH EASTERN ELECTRICITY BOARD

APPLICATIONS are invited for the following appointments:—

Tyne Sub-Area

DEMONSTRATOR, Alnwick Service Centre. Applicants should have a certificate of a recognised Domestic Science Training College and/or E.A.W. Certificate, preferably the latter; also experience as a demonstrator or assistant demonstrator in the electricity supply industry. Salary N.J.C. Grade 1, £500/£600 per annum. Annual increments of £20 up to £540, beyond £540 increments subject to certificate of competence. N.J.C. conditions of service.

York Sub-Area

SECOND ASSISTANT ENGINEER (O. and M. Section), Sub-Area Headquarters, York. Applicants should preferably have had experience in operation and maintenance of 66 kV and 33 kV overhead and underground systems. Salary Schedule A, Class G, Grade 7, £935/£995 per annum, N.J.B. conditions of service.

Applications stating age, qualifications and experience to be received by the Assistant Secretary (Establishments), North Eastern Electricity Board, G.P.O. Box No. 117, Carliol House, Newcastle upon Tyne, within ten days of the appearance of this advertisement. 2742

THE NUCLEAR POWER PLANT COMPANY LIMITED

DESIGN ENGINEER

required.

This is a senior appointment. Candidates must have a sound knowledge of the fundamentals of turbo-generating plant and conventional power station auxiliaries. Knowledge of control systems will be an advantage.

The appointment will be held at Knutsford and assistance with housing is offered to married men.

The company operates a contributory pension scheme.

Written applications, giving full details of qualifications and experience, should be addressed to:

The Secretary

THE NUCLEAR POWER PLANT COMPANY LTD.

Booths Hall

Knutsford, Cheshire

Quoting reference ER/MECH/35

2746

A vacancy occurs for a

MANAGING DIRECTOR

in a nationally known firm of

ELECTRICAL CONTRACTORS.

APPLICANTS should have experience in the management of a contracting business; experience in meeting executives, architects and consulting engineers an advantage. This post provides excellent opportunities for applicants with initiative and imagination to continue expansion in rapidly growing organisation.

Excellent salary and generous superannuation.

Apply stating age, experience and any technical qualifications to—Box 2747.

SOUTH EASTERN ELECTRICITY BOARD

CARTOGRAPHIC DRAUGHTSMAN, Woking District.

Salary £200-£565 per annum according to age and experience. Superannuable. Applicants should have a sound general education and experience of general drawing office routine.

Applications, naming two referees, on forms from E. Peel, A.M.I.E.E., Woking Manager, SEEBOARD, 4, Chobham Road, Woking, by 26th March, 1958.

SENIOR DRAUGHTSMAN, Sutton District.

Salary £760 to £860 under N.J.B. Schedule D, Grade 5, plus London weighting. Superannuable. Applicants should be fully trained engineering draughtsmen with a knowledge of record systems and capable of supervising a district drawing office.

Applications, naming two referees, on forms from W. B. Hayden, M.I.E.E., District Manager, SEEBOARD, 52, High Street, Sutton, Surrey, by 26th March, 1958.

G. WRAY,
Deputy Secretary.

2741

GOVERNMENT OF HONG KONG

Applications are invited for the post of

RESIDENT ELECTRICAL ENGINEER

to supervise the installation of the operational lighting and electrical services at the new KAI TAK AIRPORT at Hong Kong.

The appointment is on contract for a period of not less than 12 months in the salary range of £1,800-£2,200 per annum, depending upon experience and qualifications.

Applicants should be Corporate Members of the I.E.E. or exempt from Sections A and B of the Institution's examination. Exceptionally, applicants may be considered with lesser qualifications if possessing good theoretical knowledge and sound practical experience in electrical installation work.

The appointment includes free passages for applicant, wife and two children, free accommodation with heavy furniture or payment in lieu thereof, and free medical and dental facilities.

Apply in writing to—

Preece, Cardew & Rider
8, 10 & 12, Queen Anne's Gate
Westminster, London, S.W.1

2695

JOSEPH LUCAS (ELECTRICAL) LIMITED

Great King Street, Birmingham, 19

ENGINEER

EXPANSION of development of ignition equipment for gas turbines and allied projects creates a vacancy for a practical engineer with experience of design for economic production of electrical apparatus. The work is of a high technical standard and applicants should preferably possess an honours degree.

The post is permanent and pensionable and offers considerable scope for advancement to a progressive engineer.

Apply in writing stating age, qualifications and experience to the Personnel Manager, Joseph Lucas (Electrical) Ltd., Great King Street, Birmingham, 19, quoting reference PM/D/190.

128

TRANSFORMER DESIGN ENGINEER

APPLICATIONS are invited to fill vacancies in the Distribution Group of the Transformer Design Dept. of Bruce Peebles & Co. Ltd, Edinburgh, 5. Salary commensurate with qualifications and experience. Superannuation and production bonus schemes; 5-day week.

Apply to Chief Transformer Designer.

2709

CENTRAL ELECTRICITY GENERATING BOARD

Eastern Division

APPLICATIONS are invited for the following appointment in the Technical (Electrical) Department:—

FOURTH ASSISTANT ENGINEER, LUTON REGION.

Salary Class AX/DX, Grade 8, £710 × £25 to £835/£910 per annum.

The duties for the above position include assisting in the commissioning and maintenance of electrical plant and protective gear in generating and transforming stations.

The appointment will provide a basis for promotion to a higher technical grade, and applicants should possess qualifications of Higher National Certificate standard.

The applicant appointed will be required to reside in the Bedford district.

Applications stating age, qualifications, experience and present position should be sent to the Controller, Central Electricity Generating Board, Eastern Division, West Farm Place, Chalk Lane, Cockfosters, Barnet, Herts, to arrive not later than 22nd March, 1958, quoting reference No. 2/9049.

W. N. C. CLINCH,
Controller. 2735

Attractive Vacancy

with excellent prospects for

SENIOR ASSISTANT SALES ENGINEER

for the Midlands Area.

Experienced in the layout and selling of:—

Rotating Electrical Plant—medium and large.

Power Transformers.

H.T. and L.T. Switchgear.

Automatic Control Gear.

The right man will be well paid and will participate in a sound pension scheme.

Full details in confidence to Box 2713

(quoting "Sales Engineer" in top left-hand corner).

THE ENGLISH ELECTRIC VALVE COMPANY LIMITED

Chelmsford

DEVELOPMENT ENGINEERS required in departments concerned with television camera tubes and microwave valves.

Initial salary £1,100 per annum.

Age 28 - 35.

Experience in the development and production of similar valves, with an Honours Degree or equivalent qualifications essential.

Full details of previous experience, etc., to—

Dept. C.P.S.

336/7, Strand, London, W.C.2

quoting Ref. ER.1506L.

2675

CENTRAL ELECTRICITY GENERATING BOARD

Engineer, Nuclear Power Sub-Department

ENGINEER required in the REACTOR MECHANICAL DESIGN SECTION at Headquarters, Bankside House, London, S.E.1.

The intention is to attract applicants having a suitable background and ability who can assimilate and apply rapidly the techniques, involved in the design of pressure parts for nuclear power stations. The type of experience envisaged is a sound grounding in mechanical engineering, preferably but not necessarily associated with steam boilers, oil refineries or chemical plant. Knowledge of statutory and inspection requirements for pressure parts would be useful. The successful applicant will be given ample opportunity to supplement his knowledge as required.

Applicants should preferably hold a university degree and/or be corporate members of one of the senior engineering institutions.

Salary within scale £1,210-£1,570 or £1,435-£1,795 per annum, according to experience.

Write for application form to I. G. Ellis, Personnel Officer, 24-30, Holborn, London, E.C.1, to be returned by 31st March, 1958. Envelopes should be marked "Confidential," quoting ref. E.R./75. 2726

NORTH STAFFORDSHIRE TECHNICAL COLLEGE

Stoke-on-Trent

Principal: H. W. Webb, O.B.E., D.Sc., F.R.I.C., M.I.Chem.E., F.I.Ceram.

APPLICATIONS are invited for the post of full-time ASSISTANT LECTURER GRADE "B" in ELECTRICAL ENGINEERING, to commence in May or as soon as possible afterwards. Applicants should hold an engineering degree, or equivalent, and have had some practical experience. Qualifications and experience in the field of industrial electronics would be an advantage.

Burnham Scale salary: Basic £650 × £25 to £1,025 plus full allowances for training, graduate qualifications and industrial experience, which may in some cases bring the maximum up to £1,225 per annum.

Applications giving details of age, qualifications, training and experience, together with the names of two referees, should be sent to the principal within 14 days of the appearance of this advertisement.

H. DIBDEN,
Clerk to the Governors.
2734

DEPUTY SUPERINTENDENT WINDING DEPARTMENT

APPLICATIONS are invited for the post of DEPUTY SUPERINTENDENT of the Winding Department, dealing with A.C. and D.C. machines.

This is a senior works appointment with promotion prospects for a man having managerial experience and knowledge of modern H.T. winding methods. Good salary, bonus and pension fund, with possible assistance in housing.

Applications, which will be treated in strict confidence, should be sent to:—

Personnel Manager
LAURENCE, SCOTT & ELECTROMOTORS LTD.
Gothic Works, Norwich

2711

TRANSFORMERS (WATFORD) LIMITED

require

TRANSFORMER ENGINEER-DRAUGHTSMEN.

These appointments will command a really high salary for fully experienced applicants able to work quickly, accurately and individually from basic principles.

Apply Managing Director, Transformers (Watford) Ltd., Sandown Road, Watford, Herts. 2597

SECTION LEADER, ELECTRICAL DRAWING OFFICE

required by The Steel Company of Wales Ltd. (Steel Division), Port Talbot.

The successful candidate will be expected to take charge and supervise an office of fifteen electrical draughtsmen. He should have experience in heavy industry and be capable of preparing drawings for electrical installations, including the layout of substations and contactor rooms. A knowledge of lighting and communications would be an advantage.

Higher National Certificate or equivalent desirable.

Those wishing to apply should write giving full details of age, experience, qualifications and present salary to:—

Superintendent, Personnel Services
THE STEEL COMPANY OF WALES LTD.
(Steel Division)
Abbey Works, Port Talbot, Glam

2607

ELECTRICIANS

are required for maintenance on a wide range of equipment in a Chemical Works at Oldbury.

A proportion of their time will be spent on shift work for which a shift differential is paid.

A merit rating scheme is operated by the company which ensures that a good tradesman receives a good rate of pay.

Excellent canteen and recreational facilities are available, and applications should be made in writing giving full details to:—

K. L. H. Lloyd
Labour & Welfare Officer (Oldbury)
ALBRIGHT & WILSON (MFG.) LIMITED
P.O. Box No. 3, Oldbury

2628

A.E.I. LAMP & LIGHTING CO. LTD.

has immediate vacancies in its Lighting Department for:—

(a) LIGHTING ENGINEERS, including specialists in floodlighting and shop-lighting. Preference will be given to holders of the I.E.S. Diploma or those training for this qualification.

(b) TECHNICAL ILLUSTRATORS.

Successful applicants will be required to work in London for an initial period, but later this year the department will move to its new permanent headquarters in Leicester.

Replies stating age, qualifications, experience and salary required will be treated in confidence and should be addressed to: Manager, Lighting Department, A.E.I. Lamp & Lighting Co. Ltd., Mazda House, 44, Fitzroy Rd., London, N.W.1. Applicants may be required to attend for an interview either in London or Leicester. 2729

MECHANICAL ENGINEER

required for design of rotating electrical plant, including large hydro generators. Experience in this class of work desirable but not essential. Applicants must have practical and drawing office engineering experience. Minimum technical qualifications: Higher National Certificate in Mechanical Engineering. Compulsory pension and superannuation scheme. Assistance given with housing.

Apply, giving details of experience, etc., and salary required, to Manager, Rotating Plant Dept., Bruce Peebles & Co. Ltd., Edinburgh, 5. 2710

SENIOR DESIGNER

required, with experience in H.V. switchgear and/or overhead line fittings.

Excellent salary and prospects offered to the right man.

Write in first instance, giving full particulars, to:—

POWER CONNECTORS LTD.
2, Caxton Street, London, S.W.1

2661

CENTRAL ELECTRICITY GENERATING BOARD

Southern Division

APPLICATIONS are invited for the following position:—

DEPUTY STATION SUPERINTENDENT, PORTSMOUTH GENERATING STATION (S/13.988).

Applicants should have received a thorough technical and practical training followed by wide experience in the operation, maintenance and administration of a modern generating station. Preference will be given to corporate members of a senior professional engineering institution, or those holding similar qualifications.

Salary N.J.B. Grade G/3, £1,235 × £30 to £1,325.

Special application forms obtainable only from P. D. A. Oliver, Divisional Secretary, 111, High Street, Portsmouth, should be returned by 26th March, 1958. 2739

AIR MINISTRY

WORKS Design Branch requires in London and Provinces ELECTRICAL ENGINEERING DRAUGHTSMEN experienced in preparation of schemes for illumination and electrical equipment of buildings or in electrical distribution, H.V. and M.V. Technical training to O.N.C. standard or equivalent an advantage.

Salaries in LONDON up to £1,015 per annum. Somewhat lower in PROVINCES. Starting pay dependent on age, qualifications and experience. Long-term possibilities with pensionable and promotion prospects. 5-day week, 3 weeks 3 days leave a year.

Liability for overseas service. Normally natural-born British subjects.

Write stating age, qualifications, employment details, including type of work done, to any Employment Exchange, quoting Order No. Borough 104. 257

THE ELECTRICITY COUNCIL

Assistant to the Regional Safety Officer

THE ELECTRICITY COUNCIL requires an ASSISTANT TO THE REGIONAL SAFETY OFFICER, Yorkshire and North Eastern Region in Leeds.

Candidates should have good engineering qualifications, a knowledge of the Factory Acts and Safety Regulations, and preferably some experience in accident prevention in the electricity supply industry.

Salary within N.J.B. Grade 2, £1,160-£1,510 per annum.

Applications stating age, present salary and giving full details of qualifications and experience to E. Landucci, Winsley Street, London, W.1, to arrive not later than 28th March, 1958. Quote ref. C/8. 2706

HEATING AND ELECTRICAL ENGINEERS

required by Consulting Engineers near Tottenham Court Road, London. Applicants must have experience in the design of services in buildings, preparation of specifications, and be capable of site supervision.

Commencing salaries within the following ranges:—

JUNIOR ENGINEER, £500 to £650
INTERMEDIATE ENG'R, £700 to £850
SENIOR ENGINEER, £900 to £1100

Corporate membership of the appropriate institution for the senior positions is preferable but not essential.—Box 2748.

IMPERIAL COLLEGE OF SCIENCE AND TECHNOLOGY

LECTURERS (three) required in the Department of Electrical Engineering to meet requirements that exist for teaching and research work in (a) Physical phenomena in electrical machines; (b) Control systems; (c) Either properties of electrical materials or electronic instrumentation.

Salary scale £900 × £50 to £1,350 (bar) × £75 to £1,650 plus £60 p.a. London allowance. Family allowances and F.S.S.U.

Apply to Dept. of Electrical Engineering, Imperial College, London, S.W.7, before 20th March, 1958. 2694

Situations Vacant (continued)

SOUTH AUSTRALIA

Electrical Hand Tools

SALESMAN required for Adelaide area. Excellent opportunity for practical man with knowledge of production application and capable of selling to industrial users. Position offers career with wide scope and prospects for a man wishing to settle in Adelaide.

Nominated passage and initial housing provided.

Write, giving **age, married state,** training and experience, and with copies of testimonials, to Davis & Soper Ltd., 52 & 54, St. Mary Axe, London, E.C.3. 2693

REPRESENTATIVE

with a knowledge of selling Electric Cookers and Fires required for the YORKSHIRE area.

Applicants, who should preferably not be over 40, should have a good personality and education, be a car owner, and have sound contacts with the Area Board, electrical wholesalers and retailers in the area.

Write giving age, qualifications and experience, to—

BELLING & CO. LTD.
Bridge Works, Enfield, Middx.

2728

THE JACKSON ELECTRIC STOVE CO. LTD.
Dallow Road, Luton, Beds.

require a

DEMONSTRATOR

for each of their Birmingham and Glasgow branches. Preferably with E.A.W. Certificate. Must be thoroughly experienced in cooking, lecture demonstrating, and in the sale of apparatus. Age not under 23.

Applications giving full particulars of previous experience, which will be treated in the strictest confidence, should be addressed to the Personnel Executive at the above address. 2730

A SWITCHBOARD engineer with sound knowledge of motor control gear and having commercial and organising ability required to take charge of drawing office and engineering contracts. State qualifications and experience and salary required to—The Director, Electro Mechanical Mfg. Co. Ltd., Scarborough. 2677

APPLICATIONS are invited from suitably qualified engineers (25/35 years of age) capable of preparing complete electrical schemes for lighting, heating and power, including substation layouts and distribution for industrial undertakings. Only fully experienced engineers should apply. Salary £850/£950 p.a. Permanency. Apply — Christy Bros. Limited, Chelmsford. 2751

ARMATURE winders. Foreman required to take charge of repair shop. Sound knowledge A.C. and D.C. work. Uxbridge area.—Box 9291.

ASSISTANT electrical engineer required by steel tube manufacturers in Birmingham, to be responsible for all electrical maintenance and repairs, including a large number of overhead cranes and other lifting appliances, total load 7,000 kVA. Applicants must be between the ages of 24 and 30, have a university degree or equivalent, and have served a recognised apprenticeship or training for at least 3 years in electrical engineering. Contributory pension scheme. Apply, stating age, qualifications, experience and salary required to — Personnel Manager, Tubes Limited, Rock Lane, Aston, Birmingham, 6. 2678

ASSISTANT sales manager. A vacancy exists in a medium-sized progressive firm of control gear manufacturers for a young man between 28/35 years. Some knowledge of electrical engineering and sales office duties is desirable, but office training will be given. Successful applicant must be of good personality and capable of developing the present department into a first-class sales organisation. Position offers excellent prospects and good salary plus participation in profits bonus scheme and non-contributory life assurance and pension scheme after qualifying period. Company occupies first-class new modern premises in county of Essex. Apply in own handwriting giving full details of experience to date and positions (with salaries) previously held to—Box 2749.

ASSISTANT electrical engineer for London office work. Experience in power station work essential, including auxiliary systems, protective gear, etc. Membership of a professional institution an advantage. Good salary and prospects. Pension fund. Write details age, qualifications and experience (I.A.M./81), Balfour, Beatty & Co. Ltd., 66, Queen Street, London, E.C.4. 2676

ASSISTANT works manager required for electric cable works, paper-insulated section. Reply with full details of past experience to the Managing Director, Sterling Cable Company Ltd., Aldermaston, Berkshire. 2251

AUTOMATION. Engineer, also draughtsman, for contactor electric control gear for automation and related schemes including control of machine tools. Permanent positions. H.N.C. and O.N.C. (or equivalent qualifications) respectively preferred. Good starting salary with excellent prospects of progressive remuneration. Write in confidence, giving full details of previous experience, qualifications, age and salary expected, to—Technical Director, The Donovan Electrical Co. Ltd., Stechford, Birmingham, 33. 2679

BRITISH ENGINE BOILER & ELECTRICAL INSURANCE Co. Ltd., 24, Fennel Street, Manchester, 4. Electrical surveyors required for various districts in Great Britain. Permanent positions carrying progressive salary scale £735 to £1,060 and non-contributory pension. Candidates, age 26 to 32, preferably with H.N.C. in Electrical Engineering or Grad. I.E.E., and with apprenticeship in manufacture or repair of electrical machinery, are invited to apply in own handwriting, stating age, qualifications and experience. 2720

BRUCE PEEBLES & Co. Ltd. require two engineers of H.N.C. standard for their transformer sales and contracts departments; 5-day week. Staff pension and bonus schemes. Apply giving details of training and experience to—Manager, Transformer Dept., East Pilton, Edinburgh. 2630

CIRCUIT design draughtsmen required by company manufacturing industrial control equipment. Good salaries paid to "first-class" men. Canteen facilities, pension scheme. Housing assistance considered in approved cases. Write giving age, experience, etc., to—Personnel Officer, Dewhurst & Partner Ltd., Inverness Works, Inverness Road, Hounslow, Middx. 273

CONSULTING engineers require urgently junior electrical draughtsmen conversant with lighting and power designs for industrial building schemes. Good conditions, site visits, non-contributory pension scheme, bonus scheme, luncheon vouchers, etc. Write or phone—Messrs. A. F. Myers & Partners, 147, Victoria Street, London, S.W.1 (TAT. 8241). 2438

COPYWRITER required by West Midlands electrical manufacturing company for the preparation of press advertisements, technical publications and articles. Applications, giving age, experience and salary required should be addressed to—Box 2551.

DEWHURST & PARTNER Ltd. require technical estimator for preparing tenders in their estimating engineering department. Applicant must have good electrical engineering background and have basic knowledge of motor control equipment and its applications. The position is a senior one, and housing assistance will be given to successful applicant if necessary. Canteen facilities, pension scheme. Write giving age, experience, etc., to — Personnel Officer, Dewhurst & Partner Ltd., Inverness Works, Inverness Road, Hounslow, Middlesex. 274

DRAUGHTSMAN required by telephone manufacturers in London, S.W.8. Good electro-mechanical experience essential. Please write stating age, experience and salary required. —Box 2612.

DRAUGHTSMAN required. This is a unique opportunity for a keen young man with experience in the design and detail of electro-mechanical devices. Applicants must be willing to undertake all duties connected with a drawing office, and should be of at least O.N.C. standard. Five-day week, canteen facilities, paid holiday this year. Salary £600/£700 per annum, depending upon experience. Company situated in Hoddesdon district. Write giving full details to—Turnright Controls Ltd., West Hill, Hoddesdon, Herts. 2520

ELECTRICAL contractor requires estimating/supervising engineer for Newcastle area. Details of age, experience and salary required to—Box 2599.

DRAUGHTSMEN, both senior and junior, required. Applicants should have either contract development or diagram experience on switchgear up to 11 kV, although men with good electrical or mechanical knowledge will be considered. Excellent working conditions. Good prospects. 5-day week. Superannuation fund. Interviews arranged Saturdays if desired. Apply giving full details of training and experience to — Personnel Officer, Crompton Parkinson (Chelmsford) Limited, Chelmsford, Essex. 215

EAST African installation contractors require supervising engineer, preferably experience abroad, aged 28/35, for general work.—Box 2752

ELECTRICAL engineer, fully qualified, required as deputy to chief electrical engineer responsible for maintenance and development in a large modern factory. Experience must include large A.C. and D.C. motors, automatic control gear, H.V. and L.V. switchgear, electronics and instrumentation. Good working conditions, including excellent canteen facilities. Commencing salary up to £1,500 per annum, dependent on qualifications and experience. The successful candidate will be eligible to join a contributory pension scheme. Please give full details in reply to—Box 2754.

ELECTRICAL engineering assistants reqd. with expce. of general installation works and maintenance. Pensionable. Salaries up to £860 p.a. Prospect of promotion for those obtaining H.N.C. (Elec.). Applicn. form from Chief Engineer (58/23), L.C.C., County Hall, London, S.E.1. (422) 2753

ELECTRICAL engineers: A large engineering group who have their H.Q. in Birmingham have a few vacancies for electrical engineers in a department that provides a consulting service for a group of factories. Applicants should have had good experience on industrial electrical equipment, and a degree or its equivalent in electrical engineering is a desirable qualification. The company operates a superannuation scheme. Brief particulars of education, training and experience should be included in application addressed to Personnel Manager. —Box 2715.

ELECTRICAL engineers, junior and senior, required for consulting engineers' office in London. Salary £600-£900 depending upon age, qualifications and experience.—Box 160.

ELECTRICAL engineers require urgently junior electrical draughtsmen conversant with lighting and power designs for industrial building schemes. Good conditions. Apply—Christy Bros. Limited, Chelmsford. 2750

ELECTRICAL engineers. The Belmos Company Ltd. require additional technical staff to fill responsible positions in various departments of the organisation. The company manufactures a wide range of control gear for mining and industrial applications, including contactors, circuit-breakers and comprehensive motor control boards. The research, development and design departments have available to them good laboratory facilities, including a short-circuit test plant. The technical staff in these departments conduct interesting investigations under good conditions, and are encouraged to make full use of their initiative in the continued development of the company's products. Applications are invited from engineers of appropriate training and experience at various levels, and should be addressed to the Chief Engineer, The Belmos Company Ltd., Bellshill, Lanarkshire. 2664

ELECTRO-mechanical draughtsmen required for production drawing office of company engaged in the manufacture of control gear equipment. Good salaries paid to "first-class" men. Canteen facilities, pension scheme. Housing assistance considered in approved cases. Write giving age, experience, etc., to—Personnel Officer, Dewhurst & Partner Ltd., Inverness Works, Inverness Road, Hounslow, Middx. 275

ENGINEER (degree standard) to take charge of development work in connection with power capacitors, high-voltage transformers, and the use of a 1,500-kV surge generator. Some previous experience in works and laboratory desirable. Apply in writing in the first place to—Chief Engineer, Bryce Electric Construction Co. Ltd., Kelvin Works, Hackbridge, Wallington, Surrey. 2641

ENGINEER required for duties in contracts dept., engaged on the preparation of switchgear tenders and their subsequent engineering. Apply—The Power Equipment Co. Ltd., Kingsbury Works, Kingsbury Road, London, N.W.9. 2714

ENGINEER with wide electrical experience required by N.C.B.'s Headquarters Production Dept., but located at Stanhope Bretby, near Burton-on-Trent. Applicants should have considerable experience in the preparation of maintenance schedules covering machinery and plant connected with the mining industry and be able to prepare clear concise reports and draft technical instructions. The post will involve a considerable amount of travelling. At least H.N.C. (or equivalent) is required, preferably with membership of a recognised technical institution. Appointment (superannuable) according to qualifications and experience within range £1,250-£1,850. Write to National Coal Board, Staff Dept. (X1083 E), Hobart House, London, S.W.1, for application form, which should be returned by 24th March, 1958. 2697

ESTIMATING and contracts engineer required for expanding switchgear company. Should have H.N.C. or equivalent. Apply giving age, salary required and experience to date to—Reference AWB, Switchgear & Equipment Ltd., Banbury, Oxon. 2755

FOSTER Transformers Ltd., South Wimbledon, London, S.W.19, have vacancies for testers for work on all types of transformers up to 3,000 kVA. Applicants should have had some training or experience in the electrical industry. Apply in first instance giving details of experience and salary required to the Personnel Officer. 2522

GENERAL clerk, made or female, for elect. contractor's office near London Bridge. Costing, progress, wages, etc. Prospects of advancement for person with knowledge of trade. State salary required.—Box 9302.

IMPERIAL CHEMICAL INDUSTRIES Limited, Plastics Division, has immediate vacancies for electrical draughtsmen in the Chief Engineer's Department at Welwyn Garden City. Candidates must have served a recognised apprenticeship, and should hold Ordinary National Certificate. Experience of factory and general industrial installation work would be useful. An attractive starting salary will be offered to the selected applicants beyond which there is plenty of scope for progressive remuneration. The appointments carry membership to the staff pension fund and a profit-sharing scheme is in operation. For married men, special mortgage facilities can be granted towards house purchase, and assistance is given towards removal expenses. Temporary lodging allowances are also available for married men. Apply giving full particulars to the Staff Manager, Imperial Chemical Industries Limited, Plastics Division, Black Fan Road, Welwyn Garden City, Herts. 2680

KENNEDY & DONKIN require a number of mechanical and electrical engineers with 1st or 2nd class honours degrees, to assist in their work as consulting engineers for nuclear electricity generating stations. The appointments would be initially in London or in Manchester, but all applicants must be prepared to move to London in about two years' time. Application forms may be obtained from—Kennedy & Donkin, 64, Royal Exchange, Manchester, 2. 2698

LONDON TRANSPORT require senior assistant to be responsible to the signal engineer for technical design work on telephone system and train describers used on London Transport. Applicants should have knowledge of automatic telephony and some knowledge of carrier wave working. Technical qualifications not less than Higher National Certificate (electrical engineering). Salary range £1,210 to £1,420. Medical examination; free travel. Applications within 7 days to Staff and Welfare Officer (F/EV 674), London Transport, 55, Broadway, London, S.W.1. 2736

MANUFACTURERS of automatic electrical control equipment expanding production require commission basis representatives in the Midlands and North of England.—Box 2583.

PRODUCTION engineer. An opportunity for a man with drive and the ability to accomplish improvements in the manufacture of coated textiles and rubber and plastic mouldings. Salary £1,000-£1,200 per annum with eligibility for pension scheme. Head office in the Manchester area.—Box 2642.

REPRESENTATIVES required for Leicestershire and Northamptonshire areas. Apply in writing stating age, experience and salary required to—District Office Manager, Siemens Edison Swan Limited, 27, Highcross Street, Leicester. 2681

MIDLAND ELECTRIC MANUFACTURING Co. Ltd. invite applications for two sales representatives to concentrate on the development of their electric wiring accessories, one in the London and one in the Yorkshire area. Progressive position for man having sound connections and knowledge of accessories. Apply in confidence giving full particulars of experience and age to the Sales Director, Reddings Lane, Tyseley, Birmingham, 11. 2716

REPRESENTATIVE, 25/28 years, required for specialist selling in fittings accessories and parts by a widely known West London lighting fittings manufacturer. Previous experience in the trade an advantage, although not essential, but applications are only invited from young men who are keen, enthusiastic, ambitious and have a capacity for work. Excellent prospects. Write stating age, experience (if any) and career to date to—Box 2756.

SALES engineer required by well-known company in the Yorks area for range of L.T. switch and fuse gear. The post is a very attractive one and the existing staff are all aware of the vacancy. A young man suitably trained and preferably with a connection covering industrial users, architects, large contractors and wholesalers can make this appointment an excellent career.—Box 2758.

SALES engineer required, capable of preparing estimates and tenders for L.V. switchgear and distribution equipment. Good opportunity for young man with ability and initiative. Write giving age, experience, qualifications and salary required to—The Secretary, W. Lucy & Co. Ltd., Eagle Ironworks, Oxford. 2699

SALES engineer to operate from London office of leading manufacturers of electric motors up to 1,000 h.p. Pension scheme, bonus and opportunities for promotion for young man with the right personality and technical qualifications. Apply giving particulars in confidence of age, training, experience and salary.—Box 2757.

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SALES order clerk (male, 20-25) for lighting firm, Victoria, London, S.W.1. Preferably experienced, dealing with electrical contractors and trade users. 5-day week. Pension fund. Write fully stating salary required.—Box 2717.

SENIOR and assistant draughtsmen, experienced, for lighting and power schemes for hospital, office and school buildings, also specifications. Annual bonus, five-day week and 3 weeks' holiday. Consulting engineers, Holborn (London) area.—Box 2613.

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STEAM plant superintendent wanted for Canadian-owned 12,500-kW public utility in Georgetown, British Guiana. Age 30-40, family man preferred. H.N.C. or failing that O.N.C. desirable. Good experience with oil-fired boilers and steam turbines essential. Salary equivalent of £1,680 per annum. Free passages both ways; three months' leave at end of three-year period; interim local leave; house with electric cooker and refrigerator provided at nominal rental. Applications, in writing only, with brief qualifications to Messrs. Mackness & Shipley, Parliament Mansions, Abbey Orchard Street, London, S.W.1, who will provide full particulars before interview. 2700

STOREKEEPER required to take charge of stores, knowledge of electrical components essential. Write giving full details of experience, etc., and wages required to—Ref. FK/CEN., Reliance Telephone Co. Ltd., 43/47, Parker Street, London, W.C.2. 2701

TECHNICAL assistant, aged 20-30 years, required for control and development work in cable works laboratory. Experience in rubber preferred. Apply in writing giving full details of experience and salary required to — Chief Chemist, Hackbridge Cable Co. Ltd., Kelvin Works, Hackbridge, Surrey. 2601

WANTED, clerk/typist able to keep set of books, with knowledge of the industry preferred. Write giving age, experience and wages required.—Box 2584.

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A.C. and D.C. motors, generators, from stock.—Service Electric Co. Ltd., Honeypot Lane, Stanmore, Middx. (Edgware 5566/9). 91

A.C. and D.C. 1/- Slotmeters. Guaranteed 2 years, 2½-50 amps. From 50/-. Repairs and recalibrations. See Billiard: Tradex Meter Co., Surbiton (Tel. Elmbridge 4487). 169

ALTERNATORS from ½ to 675kVA in stock, single and three-phase, all voltages and frequencies. Guaranteed. Many unused. Send your requirements.—Fyfe, Wilson & Co. Ltd., Station Works, Bishop's Stortford. 162

ALTERNATORS, generators, 1-100 kVA, all voltages. Specialists—Powerco Ltd., 312, York Rd., London, S.W.18 (VAN. 5234). 147

ALTERNATORS, 3-phase, all sizes in stock from 7 kVA up to 330 kVA.—Britannia Manufacturing Co. Ltd., 20/26, Britannia Walk, London, N.1 (CLErkenwell 5512). 24

BARGAINS in electric motors are always being obtained from A. Cooksley & Co. Ltd., 21/25, Tabernacle Street, London, E.C.2. Stocks include A.C. and D.C. motors, second-hand and new up to 30 h.p. Starters, slide rails and pulleys. Ring Mon. 3355 for your requirements. 50

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CABLE, underground, PILC/VIR/LC, ex London stock. Cutting orders same day delivery London area. Send for priced stock lists.—Batt Electrical Co., 6, Dock Street, London, E.1 (Tel. ROYal 5905). 316

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CONVERTERS, 110 and 220 v. D.C./230 v. A.C., .5 to 6kVA; also A.C./D.C. Special voltages at short notice.—Powerco Ltd., 312, York Rd., London, S.W.18 (VAN. 5234). 150

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FLUORESCENT tubes reconditioned and guaranteed as new for 7s. 6d. each. Free collection and delivery in Lancs and Yorks.—The Anglo-American Electrical Company, Bury New Road, Breightmet, Bolton, Lancs. (Telephone, Bolton 7251). 212

FOR immediate sale, 55-kW diesel generating set by J. & H. McLaren. Recent thorough overhaul by makers. Complete with Brush alternator and control panel for use on A.C. mains, 3-phase, 415 volts, 50 cycles. May be seen running under load conditions. For further information apply—J. E. Pickard & Sons Ltd., Oxford Street, Mills, Leicester. 2665

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HEAVY twin core cab tyre flex, 248/.018, by J. & P. Carries 100 amps. Several hundred yards on drums, unused. Cheap. View — Burleigh, Alpine Wks., Empire Way, Wembley (Phone 0211). 2170

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MERCURY arc rectifier, 400/3/50 A.C. to 110 volts, 300 amps., 33 kW D.C., made by Electric Construction Company. Offers to A. S. Smith & Sons Limited, Charles Street Works, Walsall, Staffs. 2719

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MOTORS, starters, circuit breakers. Huge stocks of all types, ½ to 300 h.p. Stock list or quote by return.—J. S. Ramsbottom & Co. Ltd., Bow St., Keighley (3774-5-6). 70

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OFFERS wanted for the following equipment: British Electric transformer, 200 kVA, 6,000 v.- 400 v., 3-phase, 50 cycles; B.I. static condenser, 95 kVA, 400 v., 3-phase, 50 cycles; James Tate 150-kVA, 6,000-v. H.T. switchgear complete with meters; Metro-Vick 20-h.p. open type motor, 976 r.p.m., 400 v.—Chisholm & Co. Ltd., 42/48, South Castle St., Lverpool, 1. 2683

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ROTARY converters in stock, all sizes; enquiries invited. — Universal Electrical, 221, City Road, London, E.C.1. 34

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1,500-cycle alternators, 80 v., 25 amps.—E.W.S. Co., 69 Church Road, Moseley, Birmingham. 9247

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WANTED for prompt cash, ferrous and non-ferrous scrap, also plant for dismantling. Buyers of secondhand machinery and plant for re-use.—W. & H. Cooper Ltd., 176, Brady St., Bethnal Green, London, E.1. 120

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WANTED, rotary converters, any sizes.—Universal, 221 City Rd., London E.C.1. 35

WANTED, surplus stock cable, all types and sizes. We can inspect.—Box 220.

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£6 (six pounds) for each kilowatt of simultaneous maximum demand where "simultaneous maximum demand" means either

(a) twice the largest number of kilowatt-hours supplied by the Generating Board to the Area Board during any half-hour between 7 a.m. and 7 p.m. on any Monday, Tuesday, Wednesday, Thursday or Friday or between 7 a.m. and 12 noon on any Saturday in the year ;
or, if the sum of the simultaneous maximum demands (ascertained according to paragraph (a) above) of each Area Board and the chargeable maximum demands in the year of the other direct consumers of the Generating Board differs from 20,840,000 kilowatts by more than one per cent.

(b) the simultaneous maximum demand ascertained according to paragraph (a) above multiplied by 20,840,000 and divided by the number of kilowatts in the said sum mentioned above.

RUNNING CHARGE

0·47d. (decimal four seven of a penny) for each kilowatt-hour supplied during the year, this charge to be increased or reduced by 0·0006d. (decimal nought nought nought six of a penny) for each penny (a halfpenny or any greater part of a penny being treated as a penny) by which the fuel cost per ton in the year shall be above or below 60s. (sixty shillings).

For this purpose:

(i) "*Fuel cost per ton*" in any period shall be either

(a) the quotient produced by dividing the aggregate of the product of the *Area fuel cost per ton* in the period and the *number of kilowatt-hours supplied from generation in the Area* in the period and the product of *the residual cost per ton* in the period and *the number of kilowatt-hours imported into the Area* if any in the period by *the number of kilowatt-hours supplied in the Area* in the period; or

(b) *the Area fuel cost per ton;*
whichever is the less.

(ii) "*The Area*" means the Area of the Area Board taking the supply.

(iii) "*The Area fuel cost per ton*" in any period shall be determined as follows: the total *cost of fuel consumed* in the period at all Generating Board's stations in *the Area* shall be divided by the total number of tons *of fuel* so consumed and the cost per ton so obtained shall be multiplied by 11,000 and divided by the average gross thermal value of *fuel*, so consumed expressed in British thermal units per pound.

(iv) "*Fuel*" shall mean coal, coke and oil fuel but shall not include atomic fuels.

(v) "*The cost of fuel consumed*" shall mean the sums expended for *fuel* consumed plus the cost of any transport, handling, preparation or treatment incurred in connection with the delivery of the *fuel* to boiler hoppers or furnaces and in connection with the disposal of the products or residues of combustion, together with the proper proportion of salaries and wages and any contributions for pensions, superannuation and insurance of officers and servants attributable thereto and the amount of any rebate allowed by the suppliers from the price of heavy fuel oil delivered at the Generating Board's stations, such rebate being attributable only to a specific quantity of heavy fuel oil so delivered, less any sums received from the sale of any products or residues of combustion.

(vi) "*The number of kilowatt-hours supplied from generation in the Area*" in any period means the number of kilowatt-hours (being kilowatt-hours generated by the combustion of *fuel*) sent out from all the stations of the Generating Board in *the Area* in the period or *the number of kilowatt-hours supplied in the Area* in the period whichever is the less.

(vii) "*The number of kilowatt-hours supplied in the Area*" in any period shall mean the number of kilowatt-hours supplied in the period by the Generating Board to the relevant Area Board and to other consumers in *the Area*.

(viii) "*The number of kilowatt-hours imported into the Area*" means the amount if any by which *the number of kilowatt-hours supplied in the Area* exceeds *the number of kilowatt-hours supplied from generation in the Area*.

(ix) "*The residual cost per ton*" in any period shall mean the aggregate of—

(A) The quotient produced by dividing the amount by which the *national fuel cost per ton* in the period multiplied by the aggregate of *the number of kilowatt-hours supplied in the Area* of each Area Board in the period exceeds the aggregate of the respective products in the case of each Area Board of (a) *the Area Fuel cost per ton* in the period and (b) *the number of kilowatt-hours supplied from generation in the Area* in the period, by the aggregate of the *number of kilowatt-hours imported into the Area* of each Area Board in the period; and

(B) the sum of 6s. (six shillings).

(x) "*The National fuel cost per ton*" in any period shall be determined as follows: *the total cost of fuel consumed* in the period at all the Generating Board's stations shall be divided by the total number of tons of *fuel* so consumed and the cost per ton so obtained shall be multiplied by 11,000 and divided by the average gross thermal value of the *fuel* so consumed expressed in British thermal units per pound.

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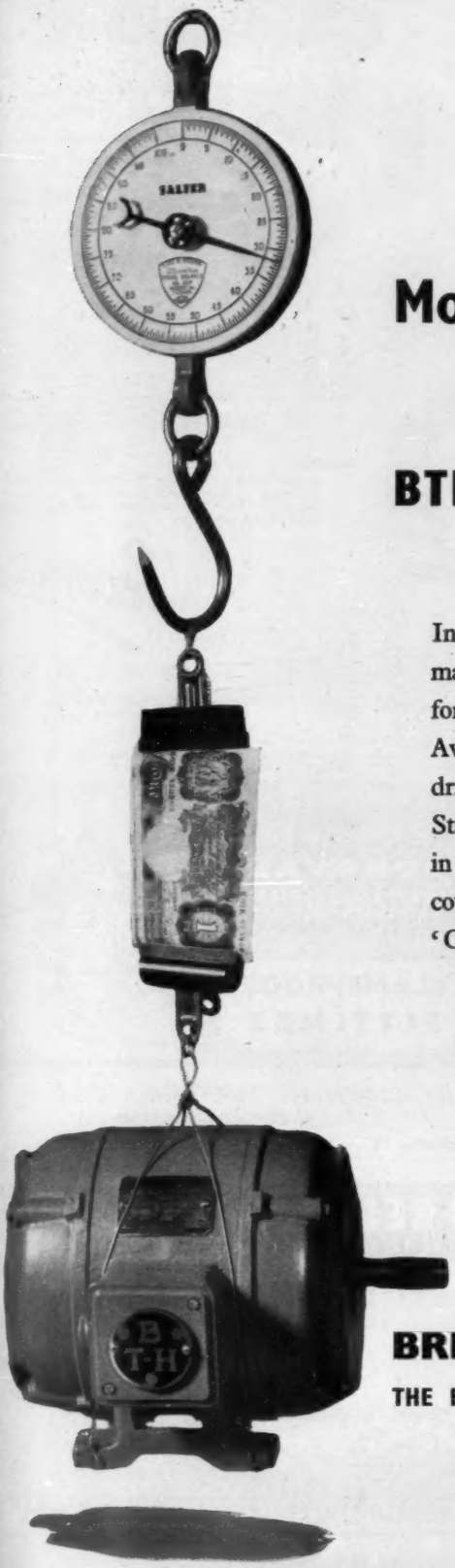

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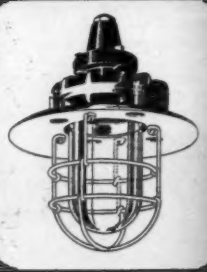

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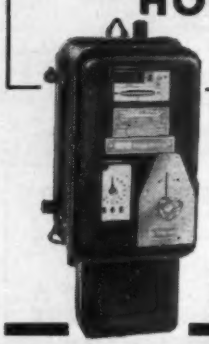

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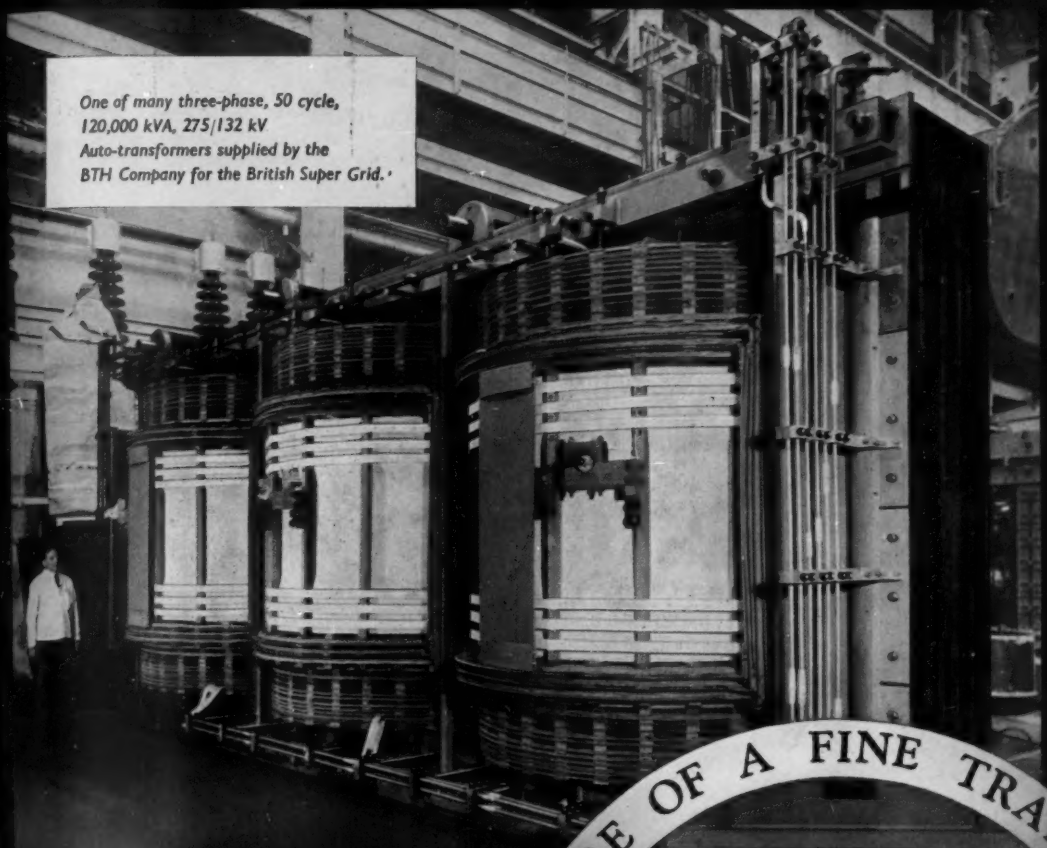

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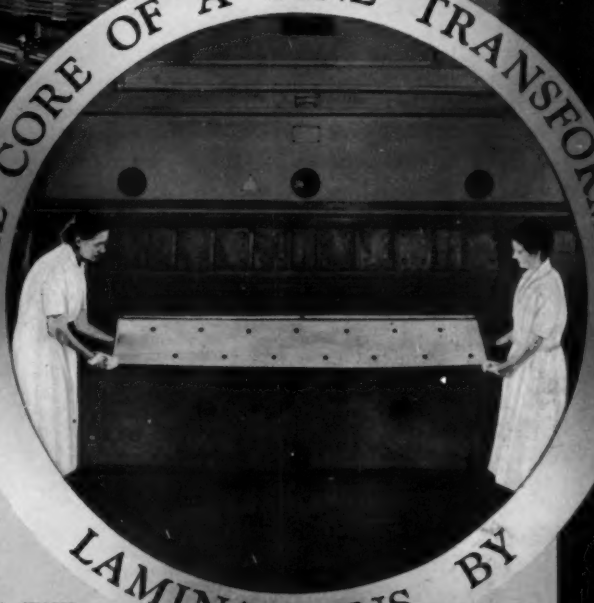

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